Volume 4

The Papers of Thomas A. Edison

THE WIZARD OF MENLO PARK

1878

Edited by Paul B. Israel, Keith A. Nier, and Louis Carlat

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Volume 4

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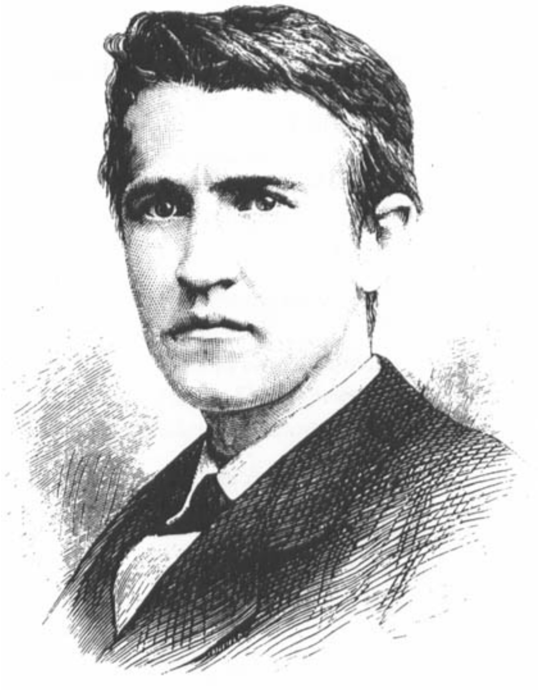

Volume 4

The Papers of Thomas A. Edison

THE WIZARD OF MENLO PARK

1878

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TO REESE V. JENKINS, whose vision became
The Edison Papers

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Preface

This volume chronicles one year, Thomas Edison's *annus magus.* In January 1878, Edison was an inventor famed in the powerful but limited financial and technical world surrounding the telegraph and telephone, supported largely by Western Union. As the winter wore on, the repercussions from his invention of the phonograph began to be felt in the wider world. He signed contracts with companies organized to exploit the new marvel, and he altered, redesigned, and improved it in his laboratory. At the same time he conducted a series of experimental tests of his carbon telephone transmitter, culminating in a mid-March design breakthrough. In early spring a New York newspaper reporter dubbed him the Wizard of Menlo Park, and soon afterward he took his phonograph to the national capital and demonstrated it to the National Academy of Sciences, members of Congress, and President Rutherford B. Hayes.

The April death of William Orton, Edison's champion at Western Union, marked a turning point in Edison's life. The new company president, Norvin Green, was far less enthusiastic about new telegraphic technologies, and Edison lost the encouragement and support the company had given his inventive work through the 1870s. In June, Edison fired the opening salvos in what became a prolonged, acrimonious priority battle over the invention of the carbon microphone, a battle that involved scientists on both sides of the Atlantic. By early summer Edison was exhausted by the constant stream of visitors and reporters, and he took the opportunity to travel west with his friend Professor George Barker to observe an eclipse and to present some of his work at a scientific meeting.

Edison spent six restorative weeks away from Menlo Park, going as far as San Francisco and "the Yosemite" in California. Shortly after his return he plunged into research on electric lighting, announcing within days that the solution was clear to him and that the subdivided, domesticated lamp was just weeks away. Those weeks would turn into four years, and the lamp into a system of dynamos, cables, meters, switches, and more, but the world's response to his rash announcement—plunging gas stocks and eager investors—was telling testament to the stature of the man popularly acclaimed as the Inventor of the Age.

The progress of the Thomas A. Edison Papers depends on the support of many individuals and organizations, including the Sponsors, other financial contributors, academic scholars, Edison specialists, librarians, archivists, curators, and students. All of the representatives of the four Sponsors have assisted the project with this volume and the editors thank them for their loyal concern and attention. The strong support of public and private foundations and of their program officers has sustained the project and helped it maintain editorial productivity.

The preparation of this volume was made possible in part by grants from the Division of Research Programs (Scholarly Publications) of the National Endowment for the Humanities, an independent federal agency; by grants from the Alfred P. Sloan Foundation, the Charles Edison Fund, and Dave and Nina Heitz; and through the support of Rutgers, The State University of New Jersey, the National Park Service (Edison National Historic Site), and the National Historical Publications and Records Commission. The editors appreciate the interest and support of many program officers and trustees, especially Douglas M. Arnold, Daniel Jones, Timothy Connolly, Michael Meier, Nancy Sahli, Richard N. Sheldon, Raphael Kasper, Doron Weber, Ralph E. Gomory, Paul Christiansen, David Shantz, John P. Keegan, and Thomas L. Morrissey. Any opinions, findings, conclusions or recommendations expressed in this publication are solely those of the editors and do not necessarily reflect the views of any of the above federal foundations or agencies, the United States Government, or any other financial contributor.

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Staff members, interns, and students not mentioned on the title page but who have contributed to this volume include Thomas E. Jeffrey, Gregory B. Field, Theresa Collins, Lisa Gitelman, Leslie Fields, Aldo Salerno, Gregory Jankunis, and Karen Detig.

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Chronology of Thomas A. Edison

1878

1–3 January	Exhibits phonograph at Western Union offices in New York.
3 January?	Designs flywheel phonograph.
7 January	Contracts for the development and manufacture of phonographic toys and clocks.
8–10 January	Tests telephone at Western Union's New York offices, further straining relations with company electricians.
12 January	With George Prescott and Gerritt Smith, makes William Orton trustee of British quadruplex patent rights.
23 January	Theodore Puskas leaves for Europe as Edison's agent for the phonograph and telephone.
29–30 January	With Charles Batchelor, visits Ansonia (Conn.) Clock Co. and experiments with applying the phonograph to clocks.
30 January	Signs agreement for commercial exploitation of the phonograph in the United States.
January	Makes flywheel phonographs to give to prominent scientific and technological figures.
	British investors in Edison's automatic telegraph assert claim to the quadruplex, beginning prolonged legal contest.
January–February	Edward Johnson undertakes lecture tours promoting Edison's phonograph and carbon telephone.
1 February	William Preece and John Tyndall demonstrate the phonograph at the Royal Institution in London, the first exhibition outside the United States.
4 February	With Henry Bentley, begins testing the carbon telephone transmitter between New York and Philadelphia.
c. 6 February	Completes design of small demonstration phonograph to be sold at the Paris Universal Exposition.
19 February	Issued first phonograph patent.

22 February	Plans series of experiments to develop a telephone receiver that does not infringe Bell patents.
28 February	Executes extensive phonograph and telephone caveats and executes three patent applications, for telephone stations and call-signal apparatus, for preventing interference between telephone lines, and for the aerophone.
1 March	Sends James Adams to Philadelphia to assist Henry Bentley with telephone tests.
2–8 March	Edward Johnson becomes general agent of prospective phonograph company and orders manufacture of first commercial phonographs.
11 March	Theodore Puskas demonstrates the phonograph at the Academy of Sciences in Paris, the first public demonstration in Continental Europe.
c. 12 March	Devises improved carbon telephone transmitter.
c. 15 March	Begins negotiations with Western Union president William Orton for a new telephone contract with the company.
19 March	Sends James Adams to London with telephone transmitters and receivers to be tested on British Post Office lines.
20 March	First public demonstration of improved carbon telephone transmitter at the Franklin Institute in Philadelphia.
Winter–Spring	Experiments with hand-powered phonographs and attempts to develop clockwork-driven cylinder and disk phonographs. Expands Menlo Park laboratory staff.
22 March	Signs agreement, negotiated by Theodore Puskas, with the London Stereoscopic and Photographic Co. for commercial exploitation of the phonograph in Great Britain.
26 March	Notification of patent interferences marks beginning of long contest over telephone patents.
29 March	The *New York World* publishes first description of Edison's medicinal preparation for relieving pain ("polyform").
March	Newspapers begin extensive coverage of Edison, which helps to spread his fame and produces crowds of visitors to Menlo Park.
March–April	Discusses with Gardiner Hubbard the possibility of Bell Telephone Co. acquiring rights to the carbon transmitter.
1 April	The *New York Daily Graphic* publishes April Fool's hoax describing Edison's "Food Creator."
4 April	Returns signed membership forms to the Theosophical Society.
6 April	Makes first of several loans to Joseph Murray to pay back rent on Ward Street shop in Newark.
8 April	Biographical sketch by George Bliss published in the *Chicago Tribune.*

10 April	Dubbed “Wizard of Menlo Park” by the *New York Daily Graphic.*
18–19 April	Demonstrates phonograph for the National Academy of Sciences, members of Congress, and President Rutherford B. Hayes.
19 April	The *Washington Star* publishes first account of Edison’s tasimeter principle and describes his hearing aid device, prompting numerous inquiries.
22 April	William Orton dies.
24 April	Edison Speaking Phonograph Co. is incorporated.
April	Publishes “The Future of the Phonograph,” ghost-written by Edward Johnson, in the *North American Review.*
1 May	Universal Exposition, with Edison exhibit, opens in Paris.
6 May	Observes transit of Mercury with borrowed telescope.
c. 8 May	Prompts Charles Harris to hire John Ott to develop toy phonograph at Menlo Park.
16 May	Develops new tasimeter design.
22 May	Visited by a delegation of Boston newspaper reporters and demonstrates telephones, the tasimeter, phonograph, and other acoustic devices.
29 May	Executes second phonograph caveat, based on European patent specifications completed in early May.
30 May	Demonstrates phonograph with Charles Batchelor and several other associates at the Convent of Mount St. Vincent, a Catholic girls’ school near Yonkers, N.Y.
31 May	Executes agreement assigning telephone patents to Western Union for six thousand dollars annually for seventeen years.
May	Edison Speaking Phonograph Co. hires James Redpath to manage phonograph exhibitions and begins training exhibitors.
May–June	Develops new hand-crank phonograph for exhibition.
	Arranges phonograph and telephone sales agencies for Australia and Central and South America.
1 June	Makes George Gouraud his agent for telephone in Great Britain.
	Stockton Griffin becomes Edison’s secretary.
2 June	Starts nephew Charles Edison on experiments to develop a non-infringing telephone receiver, which continue through the end of the year.
8 June	Publishes letter in the *New York Daily Tribune* asserting priority to microphone principle claimed by David Hughes, beginning protracted dispute.
12 June	Orders twenty-five transmitting and receiving telephone sets for sale abroad from Partrick & Carter in Philadelphia.

26 June	Receives first honorary doctorate, from Union College in Schenectady, N.Y.
Spring	Attempts to develop hearing aid and other acoustic devices.
3 July	With Charles Batchelor, begins to investigate causes of noise along New York's Metropolitan Elevated Railroad.
8 July	Writes letter to the *Chemical News* asserting priority over Edwin Houston and Elihu Thomson for the telephone repeater.
13 July	Leaves from New York with George Barker for solar eclipse expedition to Rawlins, Wyo., and a month-long vacation in the western United States.
17 July	Begins funding Patrick Kenny's facsimile telegraph experiments.
20 July	Purchases hunting and fishing equipment in Laramie, Wyo.
29 July	Attempts to measure heat of solar corona with tasimeter during total eclipse.
July–August	Charles Batchelor and Edward Johnson make improvements to exhibition phonograph.
1–3 August	Visits San Francisco.
c. 6–7 August	Tours Yosemite and stays overnight in nearby Mariposa, Calif.
9 August	Spends night at Virginia City, Nev., where he inspects mines and discusses problems of heat and ventilation in the shafts.
c. 15 August	Goes hunting and fishing in Wyoming.
21 August	Visits George Bliss in Chicago.
22 August	Receives news of award of a Grand Prize from the Paris Universal Exposition.
23 August	Presented as new member of the American Association for the Advancement of Science at the annual meeting in St. Louis, and delivers a paper on the tasimeter.
24 August	Returns to Chicago.
26 August	Arrives in Menlo Park.
27 August	Begins electric light experiments.
c. 1 September	Edward Johnson begins exhibition of improved phonograph in New York City and later includes other Edison inventions.
8 September	With Charles Batchelor, George Barker and Charles Chandler, visits William Wallace's shop in Ansonia, Conn., to see electric light and power apparatus.
10 September	Drafts first electric lighting caveat.
13–16 September	Announces he has solved problem of incandescent electric lighting.

c. 14 September	Receives dynamo from William Wallace.
19 September	Begins to receive offers from prospective electric lighting investors.
21 September	Theodore Puskas forms company for commercial exploitation of Edison and Elisha Gray telephones in France.
27 September	Drafts second electric lighting caveat.
3 October	Agrees to allow Grosvenor Lowrey to conduct negotiations with prospective investors.
5 October	Executes first patent application for electric lighting.
5–18 October	Works on new phonograph for business dictation.
16 October	Edison Electric Light Co. incorporated, principally by investors connected with Western Union and Drexel, Morgan & Co.
23–26 October	Confined to bed by facial neuralgia.
26 October	Edison's second son, William Leslie, is born in Menlo Park.
30 October	Angered by investors' concern over William Sawyer's and Albon Man's joint claim to priority in electric lighting.
October	Executes four patent caveats on electric lighting.
	Purchases a new steam engine, a Weston dynamo, and a second Wallace dynamo.
	Begins construction of new machine shop and office buildings.
6 November	Conducts telegraphic conversation with Lemuel Serrell about filing new lamp patent in Britain.
13 November	Hires Francis Upton to conduct search of relevant technical and scientific literature in order to allay fears of Edison Electric Light Co. investors.
15 November	Agrees to assign lighting patents to Edison Electric Light Company for thirty thousand dollars plus stock and royalties.
c. 20 November	Designs two dynamos, one of which is included in a British patent application.
22 November	Begins negotiating with Gold and Stock regarding new electromotograph telephone receiver.
23 November	With Edison's support, Uriah Painter and Edward Johnson take control of Edison Speaking Phonograph Co.
29–30 November	Designs first electric meter.
November–December	Displays various electric lighting devices at Menlo Park for Edison Electric Light Co. investors.
	Compares operating costs of gas, arc, and incandescent lighting systems.
	Negotiates through Grosvenor Lowrey with Drexel, Morgan & Co. for foreign rights to electric lighting inventions.

3 December	Executes first patent application for an electric generator, based on earlier tuning-fork engine.
14 December	Laboratory workers begin moving equipment into new building.
c. 15 December	Hires Francis Upton as mathematical and experimental assistant.
December	Acquires Siemens and Gramme dynamos and begins extensive tests of existing generator technology.
Late December	Designs and begins to build new dynamo.

Editorial Policy

The editorial policy for the book edition of Thomas Edison's papers remains essentially as stated in Volumes One, Two, and Three. The additions that follow stem from new editorial situations presented by documents in Volume Four.

Organization

Telegrams. In this volume, there are several telegraphic exchanges that have been assembled into single documents. Although the editors have treated telegrams as letters in earlier volumes, the increasing number of included telegrams and the existence of these exchanges warrants some explicit discussion. As documents, telegrams have a peculiar status. Unlike a common letter, a telegram is not one physical document transmitted from writer to reader. In normal commercial practice, a customer wrote a message (or dictated it to a clerk or sending operator); the sending operator read and transmitted the message; another operator received and transcribed the message back to paper; and that transcription was delivered. One might argue that the customer's written words are just a draft, that the electrical transmission is the real message, and that the words transcribed at the receiving end are just a copy. Indeed, in cases where only one message survives, we must first be willing to posit that what the operator sent was identical to what was written on the message form and that the receiving operator heard the message correctly. Such epistemological concerns are duly noted, but they are of little help to documentary editors. More concretely, if the messages written by the customer and the receiving operator both survive but are not identical, which is the "real" message? In such a case differences have to be noted in editorial apparatus, and primacy assigned according to editorial assessment of the relative importance of the sender's intent and the reader's reception of the information. But there are other issues as well. For example, messages written for sending often contain emendations. In reproducing ordinary correspondence, documentary editors transcribe (or note) interlineations and overwritten or canceled letters or words. Such changes are understood to have been seen and interpreted by the letter's recipient, who mentally assembled the clear text. The editors are treating telegraphic messages as written by the sender just as they treat letters, and emendations will appear with the understanding—as is the case with correspondence—that the message is the clear text. This is especially true given that one end of the communication was often at Menlo Park, where Stockton Griffin, Edison, or another laboratory staff member was operating the telegraph and participating in the exchange.

Several documents in this volume comprise multiple telegrams exchanged between two parties on the same day which essentially constitute conversations. The decision to create these documents recognizes a historical circumstance that might argue otherwise; namely, that mail in the late nineteenth century was delivered several times a day in many places. Two or even more letters could be sent and received on the same day. However, the editors have not treated such postal exchanges as single documents for two principal reasons: the nature of telegraphic practice produced a dialogue in these exchanges that was terser and more focused than correspondence; and, in general and in the selected instances, the telegraph exchanges were more rapid than correspondence.

Administrative matters recorded on the telegram—cost, the initials of the sending or receiving operators, addresses, word count—are omitted unless they are deemed significant, in which case they will appear in endnotes.

Form

Transcription principles. Stockton Griffin, who was a notary public, embossed certain laboratory notebook entries from September and October 1878 with his seal. He marked many others with a stamp that said, "Personally appeared before me this day of 18 , the said Thos. A. Edison, Chas. Batchelor, John Kreusi, and Martin Force, and acknowledged the above to be their signatures. Notary Public." He signed very few of the stamped pages and never filled in the blanks. Neither the stamp nor the seal have been noted in the textnotes.

Also during the fall of 1878, William Carman copied certain experimental records into the Experimental Researches volumes (Cats. 994–98). When he did so he noted somewhere on the document the page number copied to and the date. Carman's words are not copied into the textnote, but the location of his transcription is.

Editorial Symbols

~~Newark~~ Overstruck letters
Legible manuscript cancellations; crossed-out or overwritten letters are placed before corrections
[Newark] Text in brackets
Material supplied by editors
[Newark?] Text with a question mark in brackets
Conjecture
[Newark?][a] Text with a question mark in brackets followed by a textnote
Conjecture of illegible text
⟨Newark⟩ Text in angle brackets
Marginalia; in Edison's hand unless otherwise noted
[ ] Empty brackets
Text missing from damaged manuscript
[—] Hyphens in brackets
Conjecture of number of characters in illegible material

Superscript numbers in editors' headnotes and in the documents refer to endnotes, which are grouped at the end of each headnote and after the textnote of each document.

Superscript lowercase letters in the documents refer to textnotes, which appear at the end of each document.

List of Abbreviations

ABBREVIATIONS USED TO DESCRIBE DOCUMENTS

The following abbreviations describe the basic nature of the documents included in the fourth volume of *The Papers of Thomas A. Edison:*

AD	Autograph Document
ADS	Autograph Document Signed
ADf	Autograph Draft
ADfS	Autograph Draft Signed
AL	Autograph Letter
ALS	Autograph Letter Signed
D	Document
Df	Draft
DS	Document Signed
L	Letter
LS	Letter Signed
M	Model
PD	Printed Document
PL	Printed Letter
TD	Typed Document
TL	Typed Letter
TLS	Typed Letter Signed
X	Experimental Note

In these descriptions the following meanings are assumed:

Document Accounts, agreements and contracts, bills and receipts, legal documents, memoranda, patent applications, and published material, but excluding letters, models, and experimental notes

Draft A preliminary or unfinished version of a document or letter

Experimental Note Technical notes or drawings not included in letters, legal documents, and the like

Letter Correspondence, including telegrams

Model An artifact, whether a patent model, production model, or other

The symbols may be followed in parentheses by one of these descriptive terms:

abstract A condensation of a document

copy A version of a document made at the time of the creation of the document by the author or other associated party

fragment Incomplete document, the missing part not found by editors

historic drawing A drawing of an artifact no longer extant or no longer in its original form

letterpress copy A transfer copy made by pressing the original under a sheet of damp tissue paper

photographic transcript A transcript of a document made photographically

telegram A telegraph message

transcript A version of a document made at a substantially later date than that of the original, by someone not directly associated with the creation of the document

STANDARD REFERENCES AND JOURNALS

Standard References

BDAS	*Biographical Dictionary of American Science*
DAB	*Dictionary of American Biography*
DB	*Dictionnaire des Biographie*
DBB	*Dictionary of Business Biography*
DBF	*Dictionnaire de Biographie Française*
DNB	*Dictionary of National Biography*
DSB	*Dictionary of Scientific Biography*
Ency. Brit.	*Encyclopaedia Britannica,* 9th edition
Ency. Brit. Supp.	*Encyclopaedia Britannica American Supplement,* 9th edition
Gde. Ency.	*Grande Encyclopédie Inventaire Raisonné des Sciences, des Lettres et des Arts*
NCAB	*National Cyclopedia of American Biography*

NGD	*New Grove Dictionary of Music and Musicians*
NUC Pre-1956	*National Union Catalog: Pre-1956 Imprints*
OED	*Oxford English Dictionary*
TAEB	*The Papers of Thomas A. Edison* (book edition)
TAEM	*Thomas A. Edison Papers: A Selective Microfilm Edition*
TAEM-G#	*A Guide to Thomas A. Edison Papers: A Selective Microfilm Edition, Part #*
WWW	*Who Was Who*
WWWS	*World Who's Who in Science*

Journals

AAAS Proceedings	*Proceedings of the American Association for the Advancement of Science*
BAAS Report	*Report of the Meeting of the British Association for the Advancement of Science*
J. Frank. Inst.	*Journal of the Franklin Institute*
J. Soc. Teleg. Eng.	*Journal of the Society of Telegraph Engineers*
J. Teleg.	*Journal of the Telegraph*
Pop. Sci. Mo.	*Popular Science Monthly*
Sci. Am.	*Scientific American*
Sci. Am. Supp.	*Scientific American Supplement*
Teleg. J. and Elec. Rev.	*Telegraphic Journal and Electrical Review;* formerly *Telegraphic Journal*
Telegr.	*The Telegrapher*

ARCHIVES AND REPOSITORIES

In general, repositories are identified according to the Library of Congress system of abbreviations. Parenthetical letters added to Library of Congress abbreviations have been supplied by the editors. Abbreviations contained entirely within parentheses have been created by the editors and appear without parentheses in citations.

CLU-S/C	Department of Special Collections, College Library, University of California, Los Angeles, Calif.
CSt	Department of Special Collections, Stanford University Library, Stanford, Calif.

DLC	Library of Congress, Washington, D.C.
DNA	National Archives, Washington, D.C.
DSI-NMAH	Archives, National Museum of American History, Smithsonian Institution, Washington, D.C.
(HuBPo)	Foundation of the Postal and Telecommunication Museum, Budapest, Hungary
MB	Boston Public Library, Boston, Mass.
MdSuFR	National Archives at College Park, Md. (formerly Washington National Records Center, Suitland, Md.)
MH-BA	Baker Library, Graduate School of Business Administration, Harvard University, Boston, Mass.
MiD-B	Burton Historical Collection, Detroit Public Library, Detroit, Mich.
MiDbEI	Library and Archives, Henry Ford Museum & Greenfield Village, Dearborn, Mich.
MiDbEI(H)	Henry Ford Museum & Greenfield Village, Dearborn, Mich.
NIC	Department of Manuscripts and University Archives, John M. Olin Library, Cornell University, Ithaca, N.Y.
NjP	Princeton University Library, Princeton, N.J.
NjWAT	Corporate Research Archives, American Telephone and Telegraph Company, Warren, N.J.
NjWOE	Edison National Historic Site, West Orange, N.J.
PHi	Historical Society of Pennsylvania, Philadelphia, Pa.
PPAmP	American Philosophical Society, Philadelphia, Pa.
(UkExU)	University Library, University of Exeter, Exeter, UK
(UkLIEE)	Institution of Electrical Engineers, London, UK

MANUSCRIPT COLLECTIONS AND COURT CASES

References to documents included in *Thomas A. Edison Papers: A Selective Microfilm Edition* (Frederick, Md.: University Publications of America, 1985–) are followed by parenthetical citations of reel and frame of that work; for example, Cat. 1185:34, Accts. (*TAEM* 22:562). Documents found at NjWOE after the microfilming of contemporaneous material will be filmed as a supplement of the next part of the microfilm edition.

Accts.	Accounts, NjWOE
ADW	Andrew Dixon White Papers, NIC
AGB	Alexander Graham Bell Papers, DLC
American Speaking Telephone Minutes	American Speaking Telephone Co. Minutes, Western Union Collection, DSI-NMAH
A&P Executive	Atlantic and Pacific Telegraph Co. Executive Committee Minutes, Western Union Collection, DSI-NMAH
American Graphophone Co. v. Leeds & Catlin	*American Graphophone Co. v. Leeds & Catlin Co.*, Equity No. 8,570, U.S. Circuit Court, Southern District of New York, RG-21, MdSuFR.
American Graphophone v. U. S. Phonograph	*American Graphophone Co. v. The United States Phonograph Co., Victor H. Emerson and George E. Tewksbury,* Lit., NjWOE
Batchelor	Charles Batchelor Collection, NjWOE
Butler	Benjamin Butler Papers, DLC
CJB	Clarence Blake manuscripts, accession 548, MB
CR	Company Records, NjWOE
DF	Document File, NjWOE
EBC	Edison Biographical Collection, NjWOE
Edison Caveat	Edison Caveats, RG-241, MdSuFR
Edison Electric Light Co. v. U. S. Electric Lighting Co.	*Edison Electric Light Co. v. U. S. Electric Lighting Co.*, Lit., NjWOE
ESP Lbk.	Edison Speaking Phonograph Co. Letterbooks, UHP
G&S Executive	Gold and Stock Telegraph Co. Executive

	Committee Minutes, Western Union Collection, DSI-NMAH
Hummel	Charles Hummel, Wayne, N.J.
Hyatt & Mayer	Hyatt & Mayer Correspondence, NjP
JHP	Joseph Henry Papers, DSI-NMAH
Keith v. Edison v. Brush	*Keith v. Edison v. Brush,* Lit., NjWOE
Kellow	Richard W. Kellow File, Legal Series, NjWOE
Lab.	Laboratory notebooks and scrapbooks, NjWOE
Lbk.	Letterbooks, NjWOE
LBO	William Orton Letterbooks, Western Union Collection, DSI-NMAH
Ladd v. Seiler	*Ladd v. Seiler,* Patent Interference File 8765, RG-241, MdSuFR
Linke Collection	Linke Collection (M235), CSt
Lit.	Litigation Series, NjWOE
Lockyer	(Joseph) Norman Lockyer Papers, UkExU
Meadowcroft	William H. Meadowcroft Collection, NjWOE
MGF	Moses G. Farmer Papers, CLU-S/C
MM Coll.	Miscellaneous Manuscript Collection, PPAmP
Miller	Harry F. Miller File, Legal Series, NjWOE
Nicholson v. Edison	*Nicholson v. Edison,* Patent Interference Files 8689–90, RG-241, MdSuFR
Pat. App.	Patent Application Files, RG-241, MdSuFR
Pioneers Bio.	Edison Pioneers Biographical File, NjWOE
PPC	Primary Printed Collection, CR, NjWOE
Pritchard	Michael Pritchard, Cardiff, UK
PS	Patent Series, NjWOE
Quad.	Quadruplex Case (Vols. 70–73 and Telegraph Law Cases [TLC]), NjWOE
RGD	R. G. Dun Collection, MH-BA
Sawyer & Man v. Edison	*Sawyer & Man v. Edison,* Lit., NjWOE
Sawyer & Man v. Edison (U.S.)	*Sawyer & Man v. Edison,* contained in *Edison Electric Light Co. v. U. S. Electric Lighting Co.,* Lit., NjWOE

Scraps.	Scrapbooks, NjWOE
Sprague v. Edison	*Sprague v. Edison, Case B,* Lit., NjWOE
Telephone Interferences	*Edison v. Gray v. Dolbear et al.,* Patent Interference Files 6627, 6628, and 6630, RG-241, MdSuFR
TI	Telephone Interferences (Vols. 1–5), NjWOE; a printed, bound subset of the full Telephone Interferences
TP	Theodore Puskas Collection, HuBPO
UHP	Uriah Hunt Painter Papers, PHi
WHP	William H. Preece Papers, UkLIEE
WUTAE	Envelope of Edison letters, Letterbox 8, Western Union Collection, DSI-NMAH

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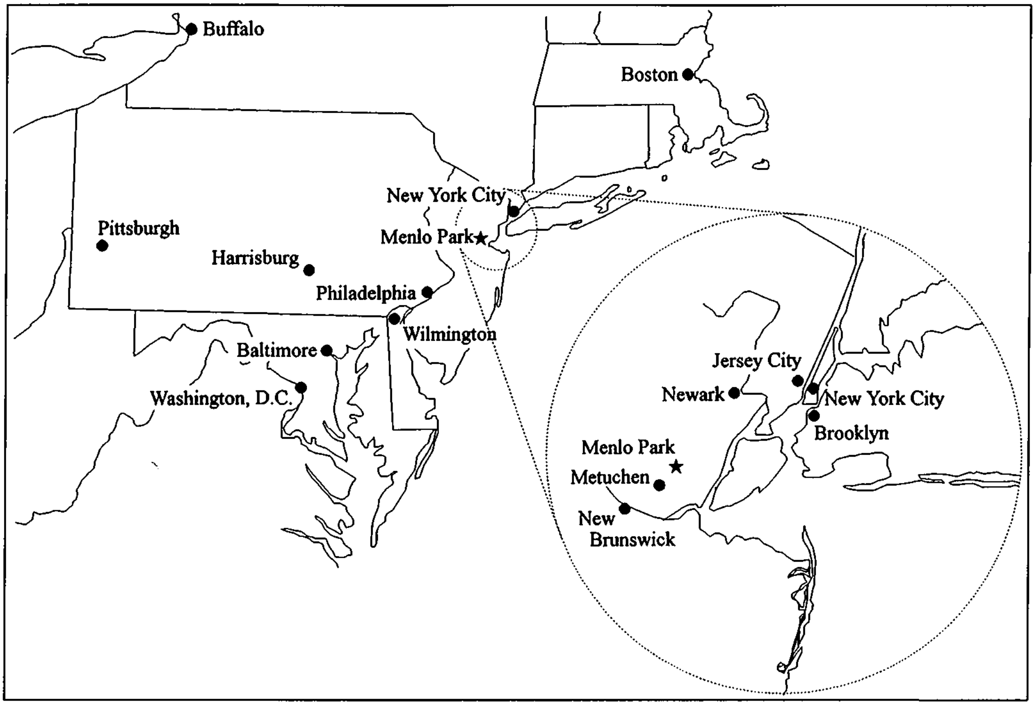
THE WIZARD OF MENLO PARK
1878



Buffalo
Boston
New York City
Menlo Park
Pittsburgh
Harrisburg
Philadelphia
Wilmington
Baltimore
Washington, D.C.
Jersey City
Newark
New York City
Brooklyn
Menlo Park
Metuchen
New Brunswick

A map showing Menlo Park, N.J., and other towns and cities in the region associated with Edison's career in 1878.

-1- January–February 1878

As the new year began, Edison was busy exhibiting and experimenting with the two inventions that had emerged from the Menlo Park laboratory at the end of 1877—the phonograph and the carbon telephone transmitter. The effort to develop these inventions into commercial products would remain the focus of Edison's attention during the first half of 1878.

During the first few days of the year, Edison exhibited a new phonograph (his second cylinder design) at Western Union headquarters in New York City. With the appearance of the first newspaper reports about the machine and its inventor, this marvel also began to excite public interest. Edison had begun making commercial arrangements even before the wider public knew of the phonograph. At the end of December, Hungarian entrepreneur Theodore Puskas acquired European rights, and Uriah Painter and Edward Johnson began to negotiate for American rights on behalf of Gardiner Hubbard and the Bell telephone interests.[1] These latter negotiations produced an agreement at the end of January that led to the creation of the Edison Speaking Phonograph Company. Among those connected with the new company was Hilborne Roosevelt, a noted organ manufacturer, who provided one of his instruments for Edison to use in his acoustic experiments at the Menlo Park laboratory.

While Edison negotiated with Hubbard (through Painter) regarding American rights to the phonograph, James James, whom Edison had first met a year earlier, negotiated two other agreements for the use of the phonograph (in toys and in speaking clocks) which were completed on 7 January. The speaking clocks were to be made by the Ansonia Clock Company, and on 29 January, Edison and Charles Batchelor visited the company's works in Ansonia, Connecticut, where they conducted the first experiments on clock phonographs.

As the Western Union phonograph exhibition came to an end, Edison decided to add a flywheel so that the cylinder would rotate more uniformly. He set Batchelor to work on the new design. By the end of January, Theodore Puskas had taken one of the new flywheel phonographs to exhibit in London and Paris, and Edison had agreed to give another to the Stevens Institute in Hoboken, New Jersey, so that Professor Alfred Mayer could conduct experiments with it. Edison and Batchelor meanwhile experimented with a third instrument at the Menlo Park laboratory.

Even with a flywheel, uniform rotation of the cylinder remained a problem. To overcome it, Edison experimented with both clockwork and steam-driven cylinder phonographs. However, regardless of the power supply, it was almost impossible to put a tinfoil recording back in the proper position for replaying once it was removed from the cylinder. He therefore planned that his standard, commercial machine would record in a spiral on a disk of tin foil, much like later phonograph disks. The foil was to be held in a frame like the one in his telegraph recorder/repeater (Doc. 857). Edison and Batchelor also experimented with various diaphragms, styluses, and other elements of the phonograph, and at the end of February, Edison summarized much of his phonograph research in a patent caveat.

While Edison was working to develop a commercial machine, he also designed a small instrument (Doc. 1195) for illustrating the principle of the phonograph. Theodore Puskas planned to offer several hundred for sale in connection with the Paris Universal Exposition, scheduled to open on 1 May, and the Edison Speaking Phonograph Company also expressed interest in this instrument. During the first two months of 1878, Edward Johnson was busy promoting the new invention through a series of lectures that included his demonstration of Edison's carbon transmitter and musical telephone.

Competition for a practical telephone was heating up in early 1878. The Bell instruments were already being used on hundreds of private lines, and the company was establishing central exchanges in several cities. Although the Bell telephone transmitted a clearly intelligible voice, the sound was quite weak. In cities, where as many as two hundred wires might be strung on a single pole, inductive interference ("cross-talk") overwhelmed the signal, and it was too weak for the important Philadelphia–New York line. Edison's carbon transmitter produced a much louder signal, and his addition of an induction coil to the circuit boosted it further.

Edison's carbon transmitter was one of several telephone designs being considered for use by Western Union as it sought to compete with Bell. During the tests of his telephone transmitter in early January, Edison became concerned by the company electricians' prejudice against him. Johnson and Painter hoped that Edison's dissatisfaction would enable them to pry him loose from his association with Western Union in order to bring him into the Bell company. To address Edison's concerns, Western Union president William Orton asked Henry Bentley of the Philadelphia Local Telegraph Company to conduct independent tests of Edison's telephone. Edison agreed to this and sent James Adams, who along with Batchelor was his principal experimenter on telephones, to assist Bentley. These tests, which began in early February, proved crucial to the development of Edison's commercial design, which emerged during the first two weeks of March.

While Edison's primary contribution to telephone technology was his carbon transmitter, he continued to work on receivers, and the laboratory conducted several tests to determine the best design for the telephonic induction coil. Edison and Batchelor also designed several complete telephone sets—transmitter, receiver, and bell or other signaling apparatus—and at the end of February, Edison executed two patent applications for such designs. When Puskas, who owned the rights to Edison's telephone patents for Europe,[2] sailed from New York in late January, he took two full sets of telephone instruments with him.

George Bliss, who had a small interest in Edison's European telephone and phonograph patents, hoped to receive an interest in American phonograph rights as well, but was left out of the arrangement Edison made with the Bell interests. Edison did, however, have Bliss arrange his Paris exhibit at the Universal Exposition. Bliss also continued to manage Edison's electric pen and autographic press business, which he had taken charge of in 1877. Bliss directed the American business from Chicago while conducting European affairs through George Beetle, his agent in Paris. To secure what was apparently his principal income, Bliss urged Edison to develop a rotary autograph press in order to compete with rival designs then being put on the market. Though Batchelor periodically returned to the instrument that he and Edison had designed a year earlier,[3] Bliss continued to be frustrated by Edison's lack of attention to the problem.

British rights to another old Edison invention—the quadruplex telegraph—became a point of contention in early January when the London firm of Smith, Fleming & Company asserted their claim under an 1873 agreement with Edison, Josiah Reiff, and George Harrington.[4] This nearly caused a rift between Edison and Reiff, who attempted to negotiate a settlement with Smith, Fleming. To protect his interest, Edison named William Orton trustee in connection with the May 1877 agreement he had signed with Western Union electricians George Prescott and Gerritt Smith regarding the disposition of their respective British quadruplex patent rights.

As the pace of work increased at Menlo Park, new members joined the staff. In early January, Martin Force, a young experimental assistant, began to work with Edison, Batchelor, and Adams in the laboratory, and John Sigel, a toolmaker from the Newark shop of Alex Pool & Company who had responded to Edison's advertisements for an experienced telegraph instrument maker, joined John Kruesi in the machine shop.[5] By early February, bookkeeper (and acting secretary) William Carman had joined the staff, which also included handymen George Carman and Alfred Swanson.[6] Even with his busy schedule, Edison found some time for relaxation. He and his wife, Mary, accompanied Batchelor and his wife, Rosa, into New York to see the magician and musician Robert Heller. And in late February, Thomas and Mary conceived their third child.

1. See *TAEB* 3:678 n. 5 and Doc. 1158.
2. See *TAEB* 3:557 n. 1, 678 n. 5.
3. Docs. 843, 852, and 854.
4. Doc. 350.
5. Force may have joined the staff in late 1877 (see *TAEB* 3:534 n. 3). For Sigel see Doc. 1391 n. 12.
6. See *TAEB* 3:6 n. 5.

-1164-

Charles Batchelor to the Editor of the English Mechanic[1]

[Menlo Park,] New Jersey, Jan. 3, 1878.[a]

EDISON'S PHONOGRAPH.

SINCE[b] my letter of December 7th,[2] Mr. Edison has improved this instrument greatly. The sounds are reproduced by the same diaphragm as you speak against, and are very much

William Orton, President of the Western Union Telegraph Co.

reinforced by the application of a large funnel shaped tube to the mouthpiece.[3] By means of this tube the reproduction of ordinary conversation can be heard distinctly 100 ft. away. The machine, as exhibited last Monday,[4] was a perfect success, whistling, singing, whispering, &c., being reproduced accurately, and the more difficult sounds, such as the "S's," the "sh" in "shall," the "ve" in "valve," and all those we found difficulty in overcoming on the telephone came clear and distinct.[5] President Orton[6] and others tested the instrument's powers of repeating spoken words.[7] On one occasion three gentlemen spoke in succession—the first in English, the second in Spanish, and the third in Hungarian[8]—and the machine repeated the words so as to be heard distinctly by a dozen persons standing around the apparatus. "Old Uncle Ned" and a verse of a Spanish love song were next sung, and reproduced by the instrument to the satisfaction of all. Mr. Edison says the machine is designed for practical use by business men and lawyers, &c. He is now making a new machine which will have a plate sufficiently large to receive 500 spoken words. Thus a man may dictate half a dozen letters before leaving his office, and his clerks may write them out in his absence. If he should wish to say more, he can remove the first plate and put in a second, and so on up to any number he may require.[9]

So accurately are the words repeated by the machine that a gentleman who was present at the exhibition would not believe that the sounds were made by it. He insisted that it was a ventriloquial performance, and would not be convinced that it was not until Mr. Edison retired into another room while the instrument was worked by some one else.

Asor.[10]

PL and PD, *English Mechanic* 26 (25 Jan. 1878): 481. In Cat. 1240, item 349, Batchelor (*TAEM* 94:105). [a]Place and date not that of publication. [b]"13897." printed at beginning of paragraph as journal item number.

[1] This printed letter comprises Batchelor's original letter to the *English Mechanic* and part of a 2 January *New York Sun* article he enclosed describing a phonograph exhibition at Western Union's New York headquarters. Cat. 1238:251 and "A Marvelous Invention," Cat. 1240, item 310, both Batchelor (*TAEM* 93:182; 94:95).

[2] Doc. 1144, which appeared in the 4 January 1878 issue.

[3] Edison had this machine by 22 December. It had a longer cylinder and employed a single diaphragm and point for both recording and replaying the sound (see Doc. 1154). Batchelor's letter is the earliest evidence of a large funnel or conical tube being used to concentrate and

Theodore Puskas in 1878.

project the sound. According to the *Operator* (15 Jan. 1878, 6), "Edison used one made of a plain piece of writing paper."

4. 31 December 1877; the phonograph was exhibited at Western Union's New York headquarters through at least 3 January. Docs. 1158 n. 4 and 1165.

5. Batchelor's handwritten letter ends here; the remainder is taken from the *New York Sun* article (see note 1). Edison later recalled that they continued to have trouble reproducing the hissing sounds and tried "a number of devices to try to re-enforce them." Edison's testimony, p. 652, *American Graphophone v. U. S. Phonograph* (*TAEM* 116: 400).

6. William Orton was president of Western Union. See *TAEB* 1:237 n. 1.

7. In addition to several people connected with Western Union, Henry Morton, president of Stevens Institute of Technology, is also known to have seen the phonograph at one of these demonstrations (*TAEB* 3:682 n. 1). The *Operator* (15 Jan. 1878, 6) described an exhibition "before a number of newspaper and telegraph men" that may have, been one of the demonstrations at Western Union.

8. Probably Hungarian promoter and inventor Theodore Puskas (Tivadar Puskás), who had just become Edison's agent for his telephone and phonograph patent rights in Europe. Doc. 1153 nn. 4–5; Gábor 1993.

9. Edison had built an experimental plate or disk phonograph by the end of December 1877 and produced various designs through January. Docs. 1161, 1174, and 1203.

10. Charles Batchelor was Edison's chief experimental assistant (see *TAEB* 1:495 n. 9, 2:72). "Asor," formed by reversing his wife's first name (Rosa), was his pen name for several letters to the *English Mechanic.*

-1165-

Edward Johnson to Uriah Painter

NYork[a] 1/3/77[78].[1]

Dr U.H.[2]

I did not get here till late last night—

Saw Edison short time today— He has been showing the Phonograph up at the Western Union[b] for past 4 Days— Says has done nothing in the Telephone or Phonograph matter as yet,—indicates that our best chance is to sell his Telephone for England I asked him for a price & he gives $25,000= as his figure[3] I don't see that any thing can be done by me. I am too far removed from the Principals for him to see any "business" in it— All I can do is to stand at his elbow & see that our price is not ignored when the W.U. ask his figures He will do nothing till they go back on him— The present indications are that they mean to treat him well till they get him committed in some way

As for the Phonograph he seems to be in no hurry as it is just now the sensation There are indications however that it is not going to prove such an easy task to perfect it as at first thought & it may happen that when the first blush wears off, he will be more ready to dicker

I have not been able to see Puskas today he is absent. I hope to see him tomorrow. I think it more than likely we will be able to do something through him or some other third party more readily than with Edison direct—as he always will trade quicker with a stranger than with his friends If I see P. tomorrow and my propositions strike him favorably I will telegraph you to come on— I know him to be a quick action negotiator, & just now he has influence enough with Edison to get him to close a bargain even in which Spencer[4] should be a chief figure— What do you think?— Is not this plan the best?.

What do you think of the 25,000 for England Can't we sell it for 50,000 easy enough? Demme me if I dont think I can do it myself— Its Dog cheap at that figure as it will as surely supplant the Bell as steam will horse power wherever competing England is a big country you know— Lets organize a Co. buy this thing & I'll go over & work it— It will bring us a big Revenue— If we do anything on this now we can no doubt get a long refusal on phonograph too—

I think Orton is going down to Menlo Park tomorrow but am not sure—

Edison has recd at the hands of a Lawyer a blank assignment calling upon him to assign his Quadruplex Patents in England to Smith Fleming & Co. of London—[5] Says he believes Reiff[6] has put them up to it— (I think so too) If so— thats the End of Reiff's hold on E—& you can do as you will with E's am[erica]n Interest Yours

EHJ[7]

ALS, PHi, UHP. [a]Preceded by "Pen Ofs." [b]Obscured overwritten letters.

1. The contents of this letter indicate its proper date.

2. Uriah H. Painter was the *Philadelphia Inquirer*'s Washington correspondent and was associated with anti–Western Union forces in the telegraph industry. See *TAEB* 2:661 n. 2.

3. On 7 January, Edison gave Painter a ten-day option on his British telephone patent, excluding the phonograph, for $25,000 (memorandum, UHP). Painter had indicated an interest in the British telephone rights at the end of December and also had had Johnson talk to Theodore Puskas about an interest in the rest of Europe (*TAEB* 3:678 n. 5). On 30 December 1877, Painter had written Gardiner Hubbard:

> I believe a monopoly of Edison & Bell here, & in Europe would easily nett million dollars in next 5 years— It is the big thing to do, competition & legal contests may eat it all up for both, & I think I

made very strong impression on him [Edison], to that effect. We will have time to trade on US, but must move promptly on Europe— [UHP]

4. Unidentified.

5. The London firm of Smith, Fleming & Co. claimed British rights to the quadruplex under their 1873 agreeement with Edison, Josiah Reiff, and George Harrington (Doc. 350). Reiff had first brought this problem to Edison's attention the previous September (Doc. 1038) but nothing more appears to have happened before January, when Smith, Fleming & Co.'s New York attorneys (Foster & Thomson) contacted Edison and Reiff, and Reiff received a letter from Smith, Fleming & Co. Edison refused to execute the assignment. On 18 January, Foster & Thompson requested an interview with him. No meeting took place, and at the end of the month John Fleming and John Puleston used the power of attorney granted in the 1873 agreement to assign Edison's British quadruplex patent (384 [1875]) to themselves as trustees. Foster & Thomson transmitted this assignment to Edison on 28 February. Reiff to TAE, 4 Jan. 1878, and Foster & Thomson to TAE, 18 Jan., 12 and 28 Feb. 1878, all DF (*TAEM* 19:451, 455, 463, 476); patent assignment, 29 Jan. 1878, Miller (*TAEM* 28:1056).

6. Josiah Reiff was a railroad investor associated with William Palmer in the Kansas Pacific Railroad and the Automatic Telegraph Co. He had provided most of the funds for Edison's automatic telegraph experiments. See *TAEB* 1:243 n. 7.

7. Edward Johnson was a former telegraph operator whom William Palmer and Reiff had hired in 1871 as general superintendent of the Automatic Telegraph Co. He and Edison became personal friends and Johnson associated with Edison for many years. In 1876 they formed the short-lived American Novelty Co., and during 1877 Johnson exhibited Edison's telephone inventions. See *TAEB* 1–3, passim.

FIRST FLYWHEEL PHONOGRAPH Doc. 1166

In mid-December 1877 Edison had modified his initial tinfoil phonograph (Doc. 1134) in several respects. He demonstrated that altered machine at Western Union's headquarters over the turn of the year.[1] In early January he modified it further by placing a substantial flywheel on the end of the shaft carrying the cylinder, thereby making a considerable improvement in the quality of sound reproduction. During the winter of 1878 he produced several phonographs of this type and used them for both exhibition and experiments. He continued to modify the phonograph in minor ways, but this constituted the basic design for the first half of the year.

In his second December phonograph Edison lengthened the cylinder so that it was twice as long as it was thick.[2] He developed a single unit (mouthpiece, diaphragm, spring, and point), rather than separate units, for both recording and playback, and he attached it to a pivoted arm that could swing away from the cylinder instead of only sliding back with the turn of an adjusting screw.[3] He mounted the mouthpiece over the curve of the cylinder instead of vertically at its side. Finally, he added a funnel to amplify the sound when it was reproduced.

Early in January, Edison decided to add a flywheel to the shaft. Simply cranking the cylinder by hand produced an uneven speed and flawed reproduction, and Edison had known from the time he built the first tinfoil machine that a steady power source (such as clockwork) would improve its performance.[4] He had, however, neither acquired nor developed one. A flywheel steadied the rotation.[5] The Western Union exhibition probably made the need for some improvement evident, because by the time it ended, on 3 January, Batchelor was working on three new phonographs that had "heavy fly wheels."[6]

When Edward Johnson departed on his telephone and phonograph exhibition tour on 20 or 21 January, Edison gave him an old phonograph—probably the one that had been exhibited at Western Union—rather than one of the new ones.[7] But when Theodore Puskas sailed for Europe on 24 January he took at least one of the flywheel machines with him.[8] The earliest surviving drawings of the new phonograph were made on 26 January, when Prof. Alfred Mayer of Stevens Institute brought an artist to Menlo Park for that purpose.[9] A week later Edison gave a machine to Mayer, who published an illustrated account of it in the April issue of *Popular Science Monthly*.[10] The design was widely publicized in American and European periodicals during the winter and spring of 1878, and it appears in the famous Mathew Brady photograph of Edison taken in April.[11]

Edison and his staff made nine of these phonographs.[12] They were all essentially the same, although contemporary engravings show slight variations.[13] Edison and Batchelor continued to experiment with every aspect of the phonograph, including attempts to power it with clockwork or steam. According to Batchelor,

> there was hardly a part anywhere about the machine that was not experimented on. I made an enormous lot of diaphragms of different kinds, of all kinds of cutting and

> indenting points, funnels of every shape to reinforce the sound on the reproducing, and also methods of regulating so that the turning of the cylinder would be more even, and many more things . . . we had different kinds of cylinders made for that style of machine, some of them with grooves cut in them of different shapes, and some of them, at least one, that was solid, had no groove at all.[14]

1. See Docs. 1154, 1158 n. 4, 1164 n. 3, and 1165. In testimony Charles Batchelor referred to this as the "second cylinder machine" and "Cylinder Machine No. 2." Batchelor's testimony, pp. 591, 596–97, *American Graphophone v. U. S. Phonograph* (*TAEM* 116:369, 372).

2. An undated measured drawing exists with the note "Cylinder 4 in Diam. 8 in long," which matches another measured drawing of 15 December 1877 (Vol. 17:5, 26, Lab. [*TAEM* 4: 877, 895]). The cylinder, as in the first phonograph, was hollow with inserted circular endplates. Charles Batchelor remembered it to be smaller in diameter and greater in length, although the diameter of the first phonograph's cylinder was also about four inches (Batchelor's testimony, p. 590, *American Graphophone v. U. S. Phonograph* [*TAEM* 116:369]). There exist two probably later machines resembling Doc. 1166, one at the Edison National Historic Site (Cat. 1400) and one at the Henry Ford Museum, Dearborn, Mich. (Cat. 00.1382.611); their ages and origins are unknown.

3. The earliest indication of the swing-arm design is the 15 December drawing (Vol. 17:26, Lab. [*TAEM* 4:895]). However, the arm shown there is about 4 inches long, while those for the first flywheel phonographs are approximately as long as the cylinder (the undated note in Vol. 17:5 specifies a length of 8¾ inches [*TAEM* 4:877]).

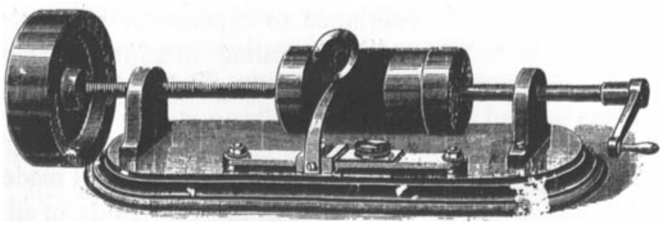
4. Docs. 1147, 1150, 1153, and 1154; the applications for U.S. Patent 200,521 and British Patent 2,909 (1877), prepared in December 1877, contain the same assumption.

5. "The Phonograph," *Engineering,* 8 Mar. 1878, Cat. 1240, item 449, Batchelor (*TAEM* 94:139). Edison explicated the virtues of the flywheel in his specification for U.S. Patent 227,679.

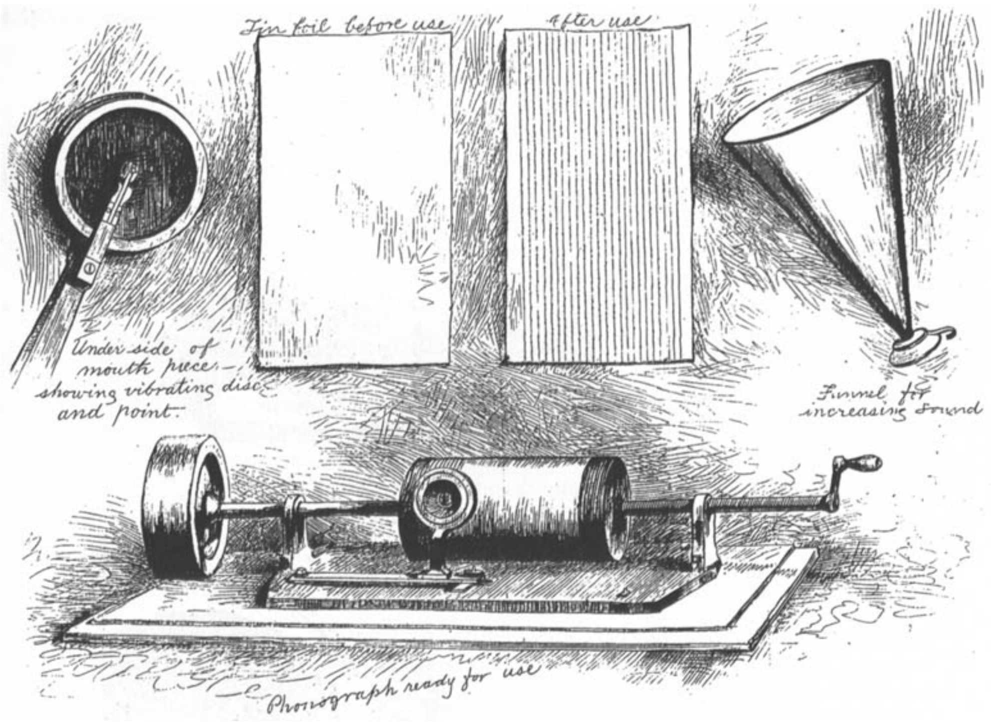
6. As Batchelor later recalled, "the fly-wheel was an afterthought for giving exhibitions." Batchelor's testimony, p. 628, *American Graphophone v. U. S. Phonograph* (*TAEM* 116:388); Cat. 1233:3, Batchelor (*TAEM* 90:54); Doc. 1175.

7. Doc. 1184.

8. Doc. 1182; "The Phonograph," *Engineering,* 8 Mar. 1878, p. 187, Cat. 1240, item 449, Batchelor (*TAEM* 94:139); Alfred Niaudet, "Le



A flywheel phonograph brought to Europe by Theodore Puskas.


Tin foil before use
After use
Under side of mouth piece— showing vibrating disc and point
Funnel for increasing sound
Phonograph ready for use

Illustrations from the 30 March 1878 issue of Harper's Weekly *showing the tinfoil phonograph with flywheel, the underside of phonograph mouthpiece with the spring and point pressed against vibrating disk, the funnel for concentrating reproduced sound, and a sheet of tinfoil before and after recording.*

Phonographe d'Edison," *La Nature,* 23 Mar. 1878, p. 257. Note that the threads are on the flywheel end of the shaft and the swing arm is centered on the base.

9. Mayer wrote Edison on 16 January to say he would come to Edison's laboratory on the 26th with a draftsman to prepare an illustration of the phonograph for publication; Batchelor recorded in his journal that two students from Stevens Institute were at the laboratory on that day, and Mayer soon had engravings in preparation. Mayer to TAE, 16 Jan. and 14 Feb. 1878, DF (*TAEM* 18:910, 918); Cat. 1233:26, Batchelor (*TAEM* 90:66).

10. A messenger picked up the machine at Menlo Park on 4 or 5 February (Cat. 1233:35, Batchelor [*TAEM* 90:70]; Henry Morton to TAE, 5 Feb. 1878, DF [*TAEM* 15:223]). The article (Mayer 1878a) was widely reprinted in the United States and abroad; see document below.

11. An extensive collection of these articles can be found in Cats. 1029 and 1032, Scraps (*TAEM* 25:161, 27:802); and Cat. 1240, Batchelor (*TAEM* 94:4).

12. Doc. 1199 n. 3. On 23 January the New York coppersmiths Donegan & Reilly delivered brass cylinders that were probably for phonographs on which Batchelor was working, although he already had completed at least one that Theodore Puskas took to Europe. Donegan & Reilly to TAE, 23 Jan. 1878, DF (*TAEM* 18:910); Doc. 1182.

13. See note 8.

14. In order to facilitate these experiments, they made the cylinder easily removable by means of "a cap on the bearing, so that if you unscrewed the cap you could lift the shaft right out." Batchelor's testi-

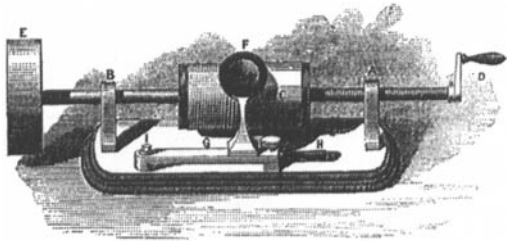
mony, pp. 591–92, *American Graphophone v. U. S. Phonograph* (*TAEM* 116:369–70).

-1166-

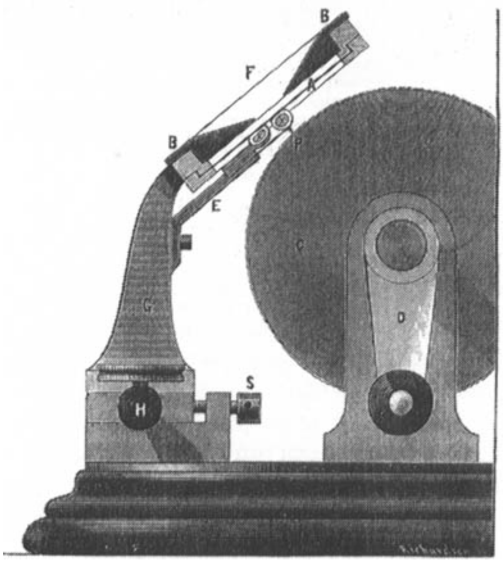
Experimental Model: Phonograph[1]

[Menlo Park, c. January 3, 1878][2]

[Fig. 1]



[Fig. 2]



M (historic drawing) (est. 79 cm × 26 cm × 20 cm), Mayer 1878a, 720–21.

1. See headnote above.

2. Mayer described the phonograph in Mayer 1878a:

> A cylinder, [C], turns on an axle which passes through the two standards, A and B. On one end of this axle is the crank, D; on the other, the fly-wheel, E. The portion of this axle to the right of the cylinder has a screw-thread cut on it which, working in a nut, A, causes the cylinder to move laterally when the crank is turned. On the surface of the cylinder is scored the same thread as on its axle. At F (shown in one-half scale in Fig. 2) is a plate of iron, A, about 1/100 of an inch thick. This plate can be moved toward and from the

> cylinder by pushing in or pulling out the lever **HG**, which turns in an horizontal plane around the pin **I**.
>
> The under side of this thin iron plate, **A** (Fig. 2), presses against short pieces of rubber tubing, **X** and **X**, which lie between the plate and a spring attached to **E**. The end of this spring carries a rounded steel point, **P**, which enters slightly between the threads scored on the cylinder **C**. The distance of this point, **P**, from the cylinder is regulated by a set-screw, **S**, against which abuts the lever, **HG**. Over the iron plate, **A**, is a disk of vulcanite, **BB**, with a hole in its centre. The under side of this disk nearly touches the plate **A**. Its upper surface is cut into a shallow, funnel-shaped cavity, leading to the opening in its centre.
>
> To operate this machine, we first neatly coat the cylinder with a sheet of foil, made to adhere by gumming the corners; then we bring the point, **P**, to bear against this foil, so that, on turning the cylinder, it makes a depressed line, or furrow. The mouth is now placed close to the opening in the vulcanite disk **BB**, and the *metal plate is talked to* while the cylinder is revolved with a uniform motion.

To play back the recording, Mayer indicated that

> The plate **A**, with its point, **P**, is moved away from the cylinder by pulling toward you the lever **HG**. Then the motion of the cylinder is reversed til you have brought opposite to the point **P** the beginning of the series of impressions which it has made on the foil. Now bring the point up to the cylinder; place against the vulcanite plate, **BB**, a large cone of paper or tin to reinforce the sounds, and then steadily turn the crank **D**.

-1167-

Edward Johnson to Uriah Painter

New York City, 1/4 1877[1878][1a]

My Dr U.H.

Whats matter with the mails I put my letter[2] in main P.O. here last Evening at 5 oclock addressed plainly U. H. Painter 900 14th St Washn D.C. I saw Walters[3] today—Says has seen parties & they are willing to sell, thinks for about 25,000— if your parties are solid—that means 15 or 20, if you act at once—is it too much? He said would write you tonight—wanted to know who your parties were. told him I only knew you in the matter—that I had simply agreed to help you by giving you information concerning it—

I told you in last nights Letter E. was willing to sell England[b] for $25,000 cash, & that he appeared to be sleeping in same[b] bed with WU folks just now—that I could do but little with him alone—am too far removed from the principals to impress him with the Idea that we mean business & can do what we agree—I can however keep under his wing & see that our proffers are respected when the W.U. come to fix a price on his telephone—& thus secure our pro-rata of the Increase The Phonograph is creating an immense stir, but I think it impresses people more as a toy than as a practical machine—& is apt to appear in its true value[b] only to us who know Edisons wonderful capacity for developing such a crude conception into a practical shape hence I believe we can afford to go Easy on it. Barton[4]—Secy of Western Electric is here & has been with Edison at Menlo Park all day His business is I doubt not in connection with this thing.[5]

I saw Puskas today. He seems to think there is more money in competition with Bell in Europe than in Coalition—says Germans—Siemens & Halske[6] are going to Contest his patent & will break it—& I'm inclined to think he is right—Bell has no new principle to[c] form a bulwark of & its more than likely many incipient Experimenters have done enough to warrant the Patent offices in giving them a patent on what they can by modification convert into a Telephone Puskas says he dont want to sell his Option Either—says he is thinking of buying the Patents himself for all European Countries. Dam the man He's got too much money— Can't you put up a scheme for you & I to get some of it?

When can you come on? we seem to make Headway when you are here & not otherwise—

The London parties have put the Lawyers on Edison for Quad in England & he blames Reiff & is wrothy— Would no doubt sell out auto Interest cheap if convinced of Reiffs hand in the London matter as he might easily be Yours,

Johnson

ALS, PHi, UHP. Letterhead of Western Electric Manufacturing Co., New York Branch, Electro-Medical Department; letterhead and dateline are electric pen copy. [a]"New York City," and "187" preprinted. [b]Obscured overwritten letters. [c]Repeated at end of one page and beginning of next.

1. The contents of this letter indicate its proper date.

2. Doc. 1165.

3. Walters and the subject of this paragraph are unidentified.

4. Enos Barton was secretary of the Western Electric Manufacturing Co. in Chicago, which manufactured Edison's electric pen (see *TAEB* 3:181 n. 14). Charles Batchelor noted Barton's visit in his diary (Cat. 1233:5, Batchelor [*TAEM* 90:55]).

5. See Doc. 1163.

6. Werner von Siemens, Johann von Siemens, and Johann Halske formed Siemens & Halske in Berlin in 1847 to manufacture telegraphs, electromedical devices, electrical meters, and railway signaling equip-

ment. The company later moved into electric power generation and distribution. Feldenkirchen 1994, 37, 49.

–1168–

To Uriah Painter

M. Park Jany. 7. 1878.

U.H.P.

Much obliged for seeing McCormick.[1] I will call on him about it. I enclose you letter[2] from Prof Jenkins a chemist of Louisville who called at my laboratory some days ago with letter of introduction from Norvin Green=[3] he is nice man all science. He went to Washington & wrote back asking[a] whether I would not like to be appointed Honorary Comr from N.J. said there was 1 paid & 2 hons from N.J. I said yes= he writes this letter= Lord If I have got to get all these letters to do it, I dont want to be an honorary Comr or any kind of Comr— What you think=[4]

Havnt seen Reiff minute I get a chance going for him= That foreign party that JCR got 50 000, presented to me through Counsel here claim for my English Quadruplex patent— hows that & I never got a cent.[5] I refused 1st because: I never recd any consideration second 'twasn't covered by contract & second I did not own it= I gave EHJ a 10 days' option at his earnest solicitation on England[6] its low, as Mr James[7] here can get it taken for that but I have asked more= Will treat ~~s the m~~ Sun man well=[8] Yours

Edison

ALS, PHi, UHP. [a] Obscured overwritten letters.

[1] Richard McCormick, former territorial governor and representative from Arizona, was Commissioner General for the United States at the 1878 Paris Universal Exposition. *NCAB* 24:338.

[2] Thomas Jenkins to TAE, 4 Jan. 1878, UHP.

[3] At this time Norvin Green (1818–1893) was vice president of Western Union. He had begun his career as a physician and served two terms in the Kentucky House of Representatives before becoming involved in the telegraph industry in 1853. He subsequently served as president of the Southwestern Telegraph Co. and became Western Union vice president in 1866 (*DAB,* s.v. "Green, Norvin"). Green's letter of introduction was dated 26 December 1877 and Jenkins came to the laboratory on either 27 or 28 December (DF [*TAEM* 14:220]; Doc. 1162).

[4] Jenkins had written to Edison on 29 December 1877 (Doc. 1162) regarding an appointment as an honorary U.S. Commissioner to the 1878 Paris Universal Exposition. In the enclosed letter Jenkins suggested that Edison get letters of recommendation from many prominent scientists and political figures.

5. This refers to Smith, Fleming and Co.'s claim to his quadruplex patent for Great Britain under the contract of 25 September 1873 (Doc. 350). See Docs. 365 and 1165 n. 5.

6. This refers to rights to Edison's British telephone patents. See Docs. 1165 and 1167.

7. On the day of this letter, Edison signed two agreements negotiated by James James for the use of his phonograph in toys and clocks. The toy contract was with Oliver D. Russell and the clock contract with Daniel Somers and Henry Davies, both of the Ansonia Clock Co. James signed separate agreements compensating himself for his role in the negotiations, and Edison also agreed to give Charles Batchelor ten percent of his interest for "experimenting for me in perfecting such apparatus." Drafts of the toy and clock agreements and a proposed list of toys prepared by Russell are in DF (*TAEM* 18:898; 19:31, 33, 35, 146); copies of the actual contracts and drafts of the two James contracts are in Miller (*TAEM* 28:1064, 1068, 1072, 1074, 1078); the Batchelor agreements are in Batchelor (*TAEM* 92:255, 259). James had been introduced to Edison by Amasa Mason, a London-based business acquaintance of Marshall Lefferts's who had been involved in negotiations for foreign rights to the electric pen in 1876 (Docs. 741 and 859). He may have been the James James listed as a lawyer in Wilson 1877, 677. He may also have been related to Daniel James of Phelps, Dodge & Co., which controlled the Ansonia Clock Co. (see Doc. 1191 n. 3).

8. Amos Cummings, managing editor of the *New York Sun*, came to the laboratory on 9 January with a letter of introduction from Painter. Painter to TAE, 3 Jan. 1878; Cummings to TAE, 8 Jan. 1878, both DF (*TAEM* 17:5–6); Cat. 1233:9, Batchelor (*TAEM* 90:57).

-1169-

From George Bliss

Chicago, Jan. 8 1878[a]

Dear Sir:

The London Co.[1] are making inquiry in regard to the Spanish patent[2] and profess to have a party in interest who desires to buy it. Beetle[3] has a good party on the string who wants to work Spain and with the ultimate view of buying the patent. Butler[4] has been attempting to work Spain and promised to go there long since. When in N. York a letter was rec'd from him saying he would be there immediately. Unless he turns up in N.Y. immediately I shall write Beetle to go ahead. It is evident that owing to the number of Spanish speaking people a patent in Spain is of much more value than has been supposed. You ought to be able to get a patent there as good as the one in Germany and which will cover all the essential features of the latest outfits. With this the trade can be controlled and you be correspondingly benefitted. If you will have the papers prepared and sent over ready to file I will try to have Beetle negotiate an agency on the basis of the party paying for the patent as a bonus. Instruct me so that he may know where to pay the money.[5] This is of course providing that you dont feel disposed to pay for it yourself and I suggest that Russia be placed on the same basis Please advise me promptly about this as Beetle is holding parties in waiting Respectfully

Geo. H. Bliss Gen. Man.[6]

ALS, NjWOE, DF (*TAEM* 18:259). Letterhead of Electric Pen and Duplicating Press, George Bliss, General Manager; letterhead and dateline are electric pen copy. [a]"Chicago," and "187" preprinted.

1. In 1876 John Breckon and Thomas Clare bought the rights to Edison's British patent for the electric pen and organized the Electric Writing Co. Their agent, Frederic Ireland, established a London office to sell the pen. *TAEB* 3, chap. 2 introduction.

2. Edison's patent attorney Lemuel Serrell wrote to him on 16 March 1878 that "the Spanish papers on the Electric pen are all ready," and his invoice to Edison for that month includes charges for those papers. DF (*TAEM* 18:637, 649); on Serrell, see *TAEB* 1:196 n. 2.

3. George L. Beetle. Nothing is known of George Beetle apart from his involvement in promoting Edison's electric pen in Europe. See *TAEM-G1*, s.v. "Beetle, George S."; *TAEM-G2*, s.v. "Beetle, George L."

4. Vesey Butler was a friend of Edison's and the agent for his electric pen in Cuba. See *TAEB* 3:194 n. 1.

5. In a 15 March 1878 letter to Theodore Puskas, Serrell listed the costs of patent procedures in 15 countries, not including Spain. The average cost was over $200. DF (*TAEM* 18:635).

6. George Bliss was general manager of the Electric Pen and Duplicating Press Co. and controlled the foreign rights outside Canada and Great Britain. Docs. 861 and 892.

-1170-

From Josiah Reiff

New York, Jany 8th 1878[a]

Edison.

When you desire anything done, you expect everyone to run & jump & nothing scarcely can satisfy your impatience, but my dear fellow you forget that when any part is due from you & it is at all unpleasant, you delay without knowing it—

If you dont desire to bust the suit against A&P Co & Domestic,[1] either Norris[2] or I should know it— He cannot push them when he[b] is compelled to ask favors of them as to delay—on your a/c—

He has been writing & telgraphing you—[3] You have been in town,[4] I hear & yet you have neither called upon him or me.

Sometimes there are joint duties and[b] responsibilities— Yours

J. C Reiff

ALS, NjWOE, DF (*TAEM* 19:451). Letterhead of J. C. Reiff. [a]"New York," and "187" preprinted. [b]Obscured overwritten letters.

1. Edison and his former manufacturing partner, Joseph Murray, had sued the Domestic Telegraph Co., which operated Edison's system of district and alarm telegraphy, for money owed them by the company. Domestic Telegraph was controlled by the Atlantic and Pacific Telegraph Co. On the suit see *TAEM* 3:604 n. 1; regarding the Domestic Telegraph Co. see *TAEM* 2, passim.

2. George Norris was the New York attorney hired by Edison and Murray for their suit against Domestic Telegraph. See *TAEM* 3:604 n. 1.

3. See Norris to TAE, 4, 12, and 27 Dec. 1877, DF (*TAEM* 14:734, 737).

4. Besides attending the phonograph exhibitions at Western Union, Edison was in New York on 8 and possibly 7 January to set up a telephone line for the company. Cat. 1233:7–8, Batchelor (*TAEM* 90: 56–57).

-1171-

Technical Note: Telephony[1]

[Menlo Park,] Jany 8 1878.[2]

Spkg Telephone

I apprehend much trouble when telephone wires become multiplied= and I think that ~~e~~induction currents in many cases will have to be abandoned[3] on account of their tension[4] & consequent liability to jump to other wires. therefore my carbon telephone[5] using 2 or 3[a] cells of battery ~~will~~ & placed directly in the line to vary its resistance will be the best. the receiving magnets which would set up high tension induction currents which would jump to other wires must be shunted to prevent this this[b] of course would lower them but by using very short spools[b] & cores slotted[6] or of fine iron wire insulated ~~th~~ it would scarcely lower them appreciable= again the Em'graph[7] which of its self sets up no return high tension current might be used hence on short lines I believe my telephone will be the only one for the future when the wires are greatly multiplied—

T A Edison

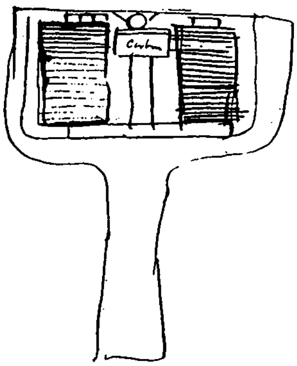
Chas Batchelor

X, NjWOE, Lab., Vol. 14:12 (*TAEM* 4:159). Written by Charles Batchelor. [a]"or 3" interlined above. [b]Obscured overwritten letters.

1. For an overview of Edison's previous work on telephones see *TAEM* 3:63–64.

2. There are five pages of telephone sketches from this day, including one showing a combined transmitter-receiver. Vol. 14:7, 10–11, 13, 8, Lab. (*TAEM* 4:156–58, 160; 162:238).

3. That is, the use of induction coils to step up the transmission voltage (see Docs. 1112, 1121, and 1139). However, Edison did not abandon



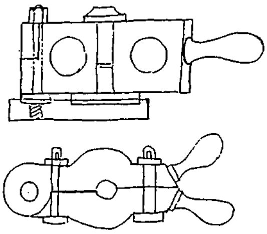
Edison's combined transmitter-receiver design of 8 January.

induction coils in telephony. In December 1877 he had proposed several arrangements using them on telephone lines and in mid-February he executed a patent application based on those designs (Doc. 1146; Vol. 14:20, Lab. [*TAEM* 4:167]; U.S. Pat. 203,019). Induction coils also remained a crucial component of the transmitting and receiving stations in his commercial telephone designs.

In a paper that William Preece delivered to the Physical Society on 19 January, "On Some Physical Points Connected with the Telephone," he discussed methods of preventing the problem of induction between wires and noted that "Mr. Edison in America has partially succeeded in effecting the first cure; but his results, though promising, have not yet reached a practical point." Preece described this "cure" as "increasing the intensity of the transmitted currents so as to overpower the currents of induction, and by reducing the sensitiveness of the receiving apparatus so as to make the instrument insensible to currents of induction though responsive to telephonic currents." He also quoted from Doc. 1123. Preece 1878a, 229–30, 35.

4. That is, high voltage.

5. In the second half of 1877 Edison had developed a telephone transmitter in which the vibrating diaphragm produced a varying resistance by pressing on a disc containing carbon (see, for example, Docs. 1081 and 1087). By this time lampblack was the preferred form of carbon. A mold for the carbons was drawn by Batchelor on 8 January and completed by John Kruesi on 13 February (NS-78-011, Lab. [*TAEM* 7:914–15]; see also Cat. 1307:70, Batchelor [*TAEM* 90:656]). What appears to be an undated description of this mold is in NS-Undated-006, Lab. (*TAEM* 8:506).



Charles Batchelor's 9 January drawings of a mold for making telephone carbons; the lower drawing was labeled "made this way."

6. Electromagnets with short cores lose and regain a magnetic field more quickly than those with long ones. Edison had experimented to the same end since 1870 with slotted electromagnet cores (see, for example, Docs. 120, 453, and 457).

7. In the spring of 1877 Edison had devised a telephone receiver employing his electromotograph principle—a change in kinetic friction caused by electrochemical decomposition. In his standard electromotograph design, Edison moved chemically saturated paper under a metal stylus. The electromotograph could respond to signals that were too weak or rapid for a standard telegraph relay. See *TAEB* 2:252 n. 2; and Docs. 873, 888–89, 908, 932, and 962.

-1172-

From George Bliss

Chicago, Jan'y 9 1878[a]

Dear Sir:

Yours of 7th at hand—[1] Glad to hear you have improved the Phonograph and that the Rotary press[2] is progressing. Barton has written out something about telephones &c but have not seen the letters. The W[estern]. E[lectric]. of late carefully keep matters from me. I had quite a hot time with the gGeneral[3] in regard to this freezing out business and he repudiated the soft impeachment![4] It makes no difference, they have all got to cave in the telephone matter, it seems to me, if merit of apparatus has any weight. Glad Barton owned the corn[5] & I hope you will give him an order for telephones as it will secure the settlement of your account.[6] Puskas is doing the right thing in hurrying off to Europe— Has that money been paid? I believe you are right in regard to Hubbard[7] and that he is not a safe man to trust. Hope Puskas can work Europe successfully but one thing is certain, if Beetle had the telephone there now he could strike heavy blows They are red hot on the subject and a man cannot get on the ground too soon. Gray[8] would take $10,000.00 cash for his half interest in their foreign patents.! He has sounded me some on pooling the Phonograph into the Telephone Co.—thought it would be a good thing &c. Now about the company and money for the Phonograph— If you will give me a good square letter agreeing to make a contract for the Phonograph providing $30,000.00 is raised in 30 days I think it can be done.[9] It is very hard to work on an uncertainty. I think you ought to do this because you need a good company to run your specialties and if I get the Phonograph shall certainly put it in good shape before the public. I have got Holland[10] warmed up again and think he will come down to put the thing through in case you give ground to stand on. I am glad you have made the contracts with[b] the clock & toy people but of course every one of these curtails the sphere of the main interest.[11] Please leave the contracts[b] with Mac[12] so that he can make & send me a copy at once. Hope Leslie will do you up in the shape you deserve=[13] You are on the track now to be appreciated by the public & not by a click= Dont fail[b] to see[c] McCormick & get that space fixed—[14] Have written Beetle all about it. I shall be delighted if you get the appointment of honorary Cmr.[b] to the Exposition[15] [-][d] Have good news from Beetle which will write in day or two— Herz is the worst kind of a fraud & is busted for funds[16] Respfly

Geo. H. Bliss G.M.

Have been pressing the Pen Company[17] and it looks well now but the Phonograph will make it a certainty

ALS, NjWOE, DF (*TAEB* 15:182). Letterhead of Electric Pen and Duplicating Press Co., George Bliss, General Manager; letterhead and dateline are electric pen copy. [a]"Chicago," and "187" preprinted. [b]Obscured overwritten letters. [c]Interlined above. [d]Canceled.

1. Not found.

2. Edison and Charles Batchelor had worked intermittently though 1877 to develop a rapid, rotary press to print copies of electric-pen stencils. See Docs. 843, 852, 854, 965, 1037, 1089, 1124, and 1143.

3. Anson Stager, president of the Western Electric Manufacturing Co. See *TAEB* 3:181 n. 13.

4. That is, he denied the accusation. *OED*, s.v. "Impeachment," 4.

5. To "acknowledge [or 'own'] the corn" is to confess to a failure or to a charge or imputation. Bliss is probably referring to the cancellation of Western Union's order for 100 of Elisha Gray's battery telephones. Farmer and Henley 1970, s.v. "Acknowledge the corn"; see Docs. 1124 and 1180.

6. This refers to Edison's electric pen royalty account with Western Electric. On 26 January, Bliss sent Edison a $200 royalty payment from Western Electric as well as $100 from himself for foreign pen royalties. Bliss to TAE, 5 and 26 Jan. 1878, DF (*TAEM* 15:174, 18:260).

7. Gardiner Hubbard, Alexander Graham Bell's father-in-law and organizer of the Bell Telephone Co., was attempting to acquire control of Edison's phonograph. See *TAEB* 3:678 n. 5; Doc. 1158.

8. Elisha Gray was a noted electrical inventor connected with Western Electric. His claim to the invention of the telephone provided one basis for Western Union's entry into the telephone business. See *TAEB* 1:402 and Hounshell 1975.

9. For Bliss's negotiations with Edison regarding the phonograph see Doc. 1158.

10. Charles Holland was Bliss's associate in marketing Edison's electric pen copying system and duplicating ink. Nothing is known of Holland apart from this association. See *TAEB* 3:288–89 and Doc. 892.

11. See Docs. 1168 n. 7 and 1190.

12. James MacKenzie. In 1862 Edison had snatched three-year-old Jimmy MacKenzie from the path of a freight car; in gratitude, his father, James, had taught Edison railroad telegraphy. MacKenzie was now manager of the American District Telegraph Co. of Detroit and seeking to become involved with Edison's telephone or phonograph inventions. *TAEB* 1:8; Docs. 1111 and 1149; MacKenzie to TAE, 15 Jan. 1878, DF (*TAEM* 15:186).

13. *Frank Leslie's Illustrated Newspaper* of 30 March contained an illustrated article, "The Latest Scientific Wonder—Edison's Speaking Phonograph." Cat. 1240, item 428, Batchelor (*TAEM* 94:129–30).

14. See Doc. 1183.

15. See Doc. 1168.

16. Cornelius Herz and inventor and manufacturer Stephen Field

had acquired rights to Edison's quadruplex for Austria, Spain, France, and Belgium when they visited Menlo Park in September 1877 (*TAEB* 3:549 n. 1; on Field see *TAEB* 2:418 n. 2). The promoter and confidence man Herz, identified as a doctor and member of the San Francisco Board of Health, had been presented to Edison by George Prescott (Docs. 1043 and 1049; for more on Herz see Simon 1971, 26, 114, 179–229).

17. Bliss had been trying to organize a foreign company for a year (see Docs. 861 and 1124), but it is unclear whether that is the company mentioned here.

-1173-

Edward Johnson to Uriah Painter

NYork Jan 10/77[78][1]

Dr UH.

Letter recd at 9 this AM.—[2] Edison in town today. Left clock contracts at home—will bring them to me tomorrow — Had you not better come on & stay till we get this matter closed up. I tell you the time to do anything is now[a] 10 days hence E. will be either in direct antagonism to the W.U. or in their breeches pocket, the latter most likely—then you & I may as well give it up. Listen now & you'll agree with me—

Day before yesterday (Tuesday)—there was a grand test of Edison & Phelps Telephone[3] in W.U. between Room 38 & Prescotts ofs[4] across the way Phelps Inst being constructed with articulation alone in view was pronounced by all to be superior in that respect— Edisons being constructed with view of practical work[b] on lines—some articulating effects being sacrificed for sake of getting plenty of sound from low talking—did not perform so satisfactorily,and his & my explanations as to the objects sought in his Telephone were met in silence no one assenting or dissenting— this sort of thing with many aggravating incidents ~~of~~commendatory of Phelps with not a single remark, from Prescott,[5] Phelps,[6] Barton, Walker,[7] (V.P. Gold & Stock) or any of the lesser lights present, to show that Edisons aim to produce a practical Instrument was appreciated—during the entire day—sent him home at night aggravated beyond anything I have yet seen. He told me this AM the whole movement was one of Blackmail— I told him now that he recognized the animal which bulldozed him in Quad times He would be a Dn fool to yield to him— He said he'd see him Damned first—that he would not bring a Telephone over again till they had changed base entirely— today h~~is~~e is in town & upon going into 38 with me—found

McTighe[8] and Gray[9] with two more Telephones (both Bells)—& the whole P. Party testing them, getting of course the same results as with the ~~Edison~~ Phelps— Barton tackled him for a pair of his (E's) Telefones.[b] I gave him the wink & he said he hadn't any ready— &c&c— Barton was evidently set back tried to coax E— when I took a hand & gave him a few reasons why E—— should not submit to that sort of competitive test— Prescott came up took same line of confab—& E went for him told him didn't see that they needed his—as they had so many around there which were superior to his &c— Prescott got nervous at once called Edison to one side & pursued him privately— I trod on his toes as he passed me—& [he][c] answered O.K.—

I since learn from E—— that Prescott has been after him E—— to sign an assignment of Quad. in England (which I tho't was done long ago—)—but E—— said he was afraid ~~to~~of P. & hesitated to do so & it was this that[d] was making P. nervous— It looks to me now[d] as though its this assignment that P. was trying to force out of E—— by looking black at the Telephone —Orton coming along, P. called him aside & said he wanted to speak to him about a matter in relation to Edison— the 3 went into P's room & it was arranged that E—— would submit to Mr.[b] Ortons decision as to the signing of the English paper[10] —Now—Edison went into O's private ofs & gave P. Hell told O. P. was trying to Black mail him— O—— ~~said~~ listened quietly then said I have not been a passive observer—& if you will pursue this matter & bring me some evidence I'll take account of it—or words to that effect— E—— now asks me to help him collect it—& I'm going to do so —You do the same— My object is to test O.—not P.— O gives E. the only encouragement[b] he gets— But is it a blind? Will he pull with E. when the crisis comes?— I've sent him (O.) a private message—by Conft'l man—to call upon his entire Telephone outfit for a thorough Competitive test on a wire 3 miles long through NY City— If he don't—its a straw in favor of the cahoots theory— If he does Edison will come off with colors flying & will have the bone to ask his price.[c]

Cheever[11] sent for me today— He wants to go down to Menlo tomorrow—very anxious to go tomorrow— I got E to stay at home with difficulty—but he will & C. goes down with me— I'll guard against any finance talk—& write you result of visit— I learn from him Hub is in Boston (Joke)[12]—& is expected in N.Y. Saty or Monday— Thus I see you are moving— I told E. so—& that he would be 10,000 richer in a week—& not to knuckle on the Telephone till then

You see today I havent had a minute to go see—Walters[13b] yesty he wasnt in. I learn Nelson[14] is trying to buy it— Kum on

EH

ALS, PHi, UHP. [a]Multiply underlined. [b]Obscured overwritten letters. [c]Document damaged. [d]Interlined above. [e]Followed by horizontal line.

1. The contents of this letter indicate its proper date.

2. Not found.

3. George Phelps's "duplex" magneto-telephone transmitter had a single mouthpiece with two diaphragms and two electromagnets located at opposite poles of a permanent magnet. (For patent purposes, Western Union claimed it was a modification of Amos Dolbear's telephone [see Doc. 1043, esp. n. 5].) Although it produced a louder signal than magneto transmitters with a single diaphragm and magnet, the second electromagnet produced inductive effects that interfered with the signal. Phelps later added condensers to overcome the induction. See Doc. 1278 for Charles Batchelor's drawing of the design. Prescott 1878c, 21–23; "Telephonic Rivalry," *Operator,* 15 Feb. 1878, 6.

(In a magneto transmitter, the speaker's voice produced vibrations in a metal diaphragm that was almost touching the core of a magnet. The diaphragm's motion created induced currents in the line wire, which was coiled around the magnet, and those currents recreated the vibrations of the voice at the telephone receiver.)

In a 10 January letter to George Ladd of the Gold and Stock Telegraph Co. of California, William Orton wrote: "I devoted an hour yesterday afternoon to experimenting with the latest improvements of Phelps and Edison. The result was more satisfactory than anything in my previous experience. The work of Phelps latest improvement is simply perfect. The articulation was distinct and you get all the modulations of the human voice even when whispering." LBO 20:407–13.

4. According to his diary, Charles Batchelor had set up a telephone circuit in the Western Union building between George Walker's room and room 39 on 7 January, and Edison and Adams had spent the following day setting up the telephone. Cat 1233:7–8, Batchelor (*TAEM* 90:56–7).

5. George Prescott was chief electrician of Western Union (see *TAEB* 1:258 n. 4). Edison's relationship with Prescott and his assistant Gerritt Smith was strained by continuing controversy over their respective roles in developing the quadruplex (see *TAEB* 2, passim). This seems to have affected Edison's relationship with other technical personnel at Western Union as well (see Doc. 1185).

6. Electrical inventor George Phelps was superintendent of Western Union's New York factory. See *TAEB* 1:135 n. 2.

7. George Walker, vice president of the Gold and Stock Telegraph

Co. and president of the American Speaking Telephone Co., had been connected with Western Union for many years, including terms as a director and vice president. He had previously been a lawyer and politician in Massachusetts. Reid 1879, 533, 539, 626, 632.

8. Unidentified.

9. Elisha Gray.

10. Under the terms of his May 1877 agreement with Prescott and Gerritt Smith, Edison had assigned his British quadruplex patent to them and they in turn had assigned it to British patent solicitor Edward Brewer. They were to divide any profits from these patents, with 35% going to Edison, 45% to Prescott, and 20% to Smith. On 12 January they signed a supplemental agreement making William Orton trustee of the patents and of their interests under the earlier contract. Agreements, 31 May 1877 and 12 Jan. 1878, DF (*TAEM* 14:683, 19: 452).

11. Charles Cheever had organized the Telephone Company of New York with Hilborne Roosevelt the previous August. He was listed as "treasurer" at 154 Nassau in Wilson 1878, 230. A member of a prominent New York family, Cheever had been crippled from birth. Tosiello 1979, 215–16.

12. This is a play on Gardiner Hubbard's name and the common nickname for Boston (the "Hub").

13. Unidentified; see the first paragraph of Doc. 1167.

14. Possibly Alfred Nelson, who had been vice president of the Domestic Telegraph Co. and treasurer of the Atlantic and Pacific Telegraph Co. See *TAEB* 3:9 n. 3.

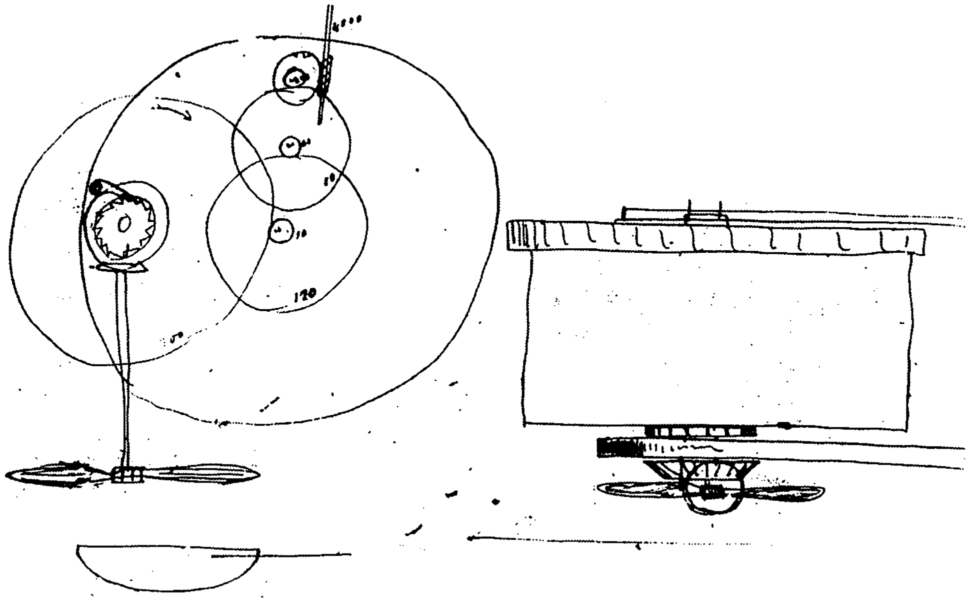
-1174-

Technical Note: Phonograph

[Menlo Park,] Jan 12 1878

Phonograph

Design the plate[1] ⟨ok⟩
"   " lever ⟨ok⟩
"   " swing post ⟨ok⟩
"   " clockwork
"   " winding arrangement ⟨ok⟩
"   " stopping mechanism
"   " throwing out mechanism
"   " Regulator[2]



two 2[a] [--][b] spring fastened to inside of Drum and the other end fastened to shaft

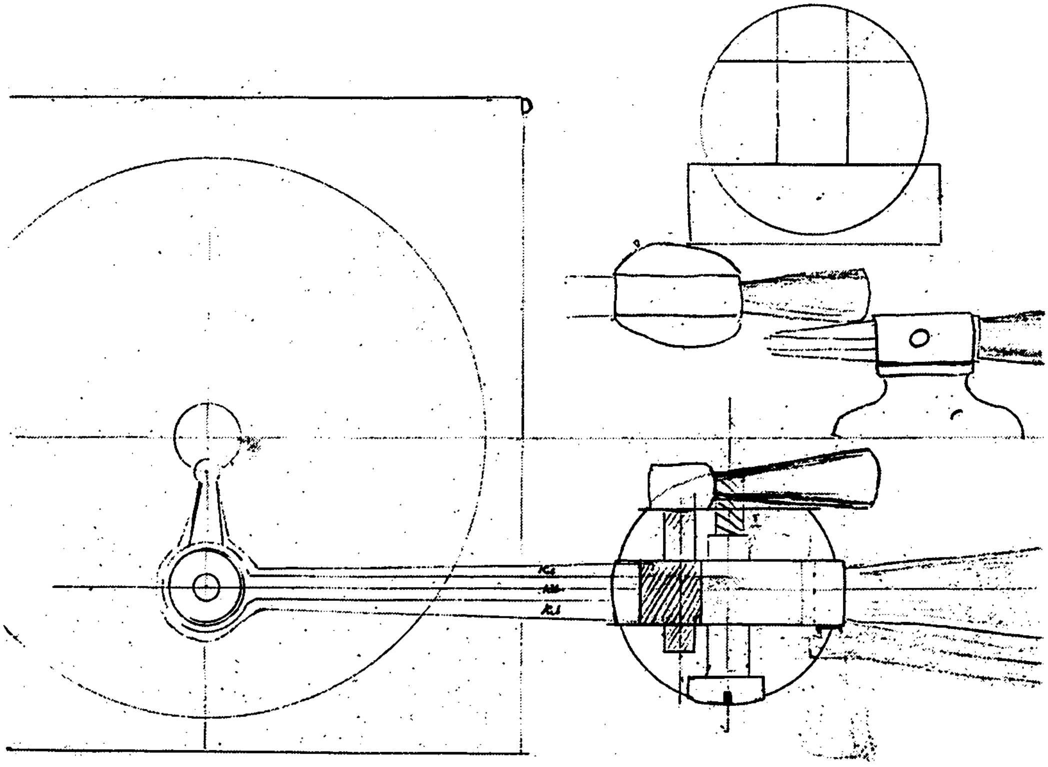
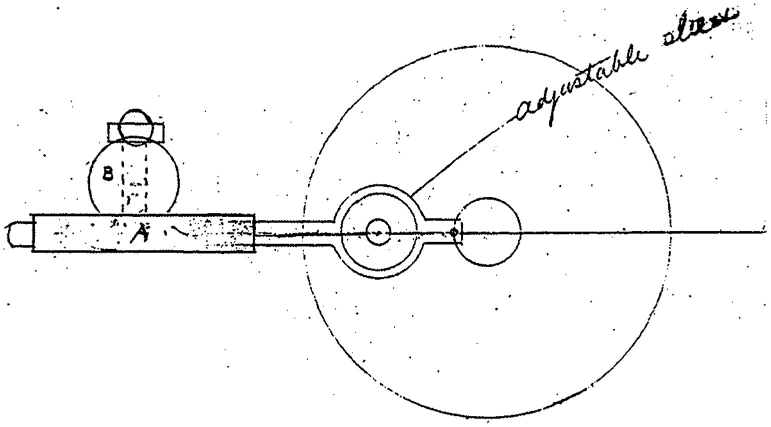


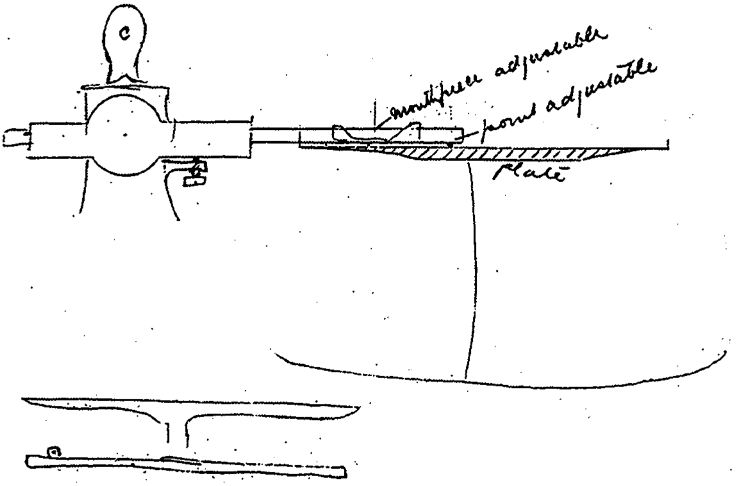
Plate and arm (swivel) with cam to clamp arm down[3]



A catches when down & is held rigid

B swivels ~~and lifts~~ with[c] arm and catches & is held in position when working

C handle[4]

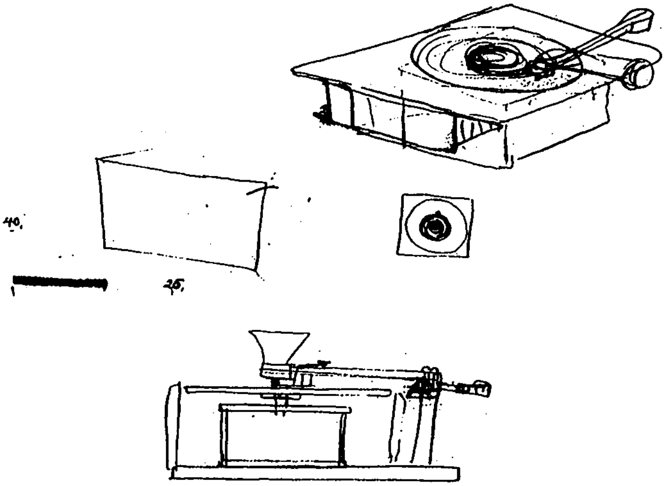


T A Edison
J Kruesi[5]

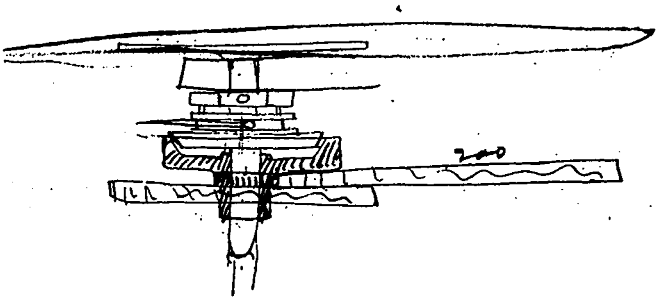
Chas Batchelor
~~G E Carman~~[6]
~~M N Force~~[7]

X, NjWOE, Lab., Vol. 17:35, 33–34 (*TAEM* 4:903, 901–2). Written by Batchelor; document multiply signed and dated. [a]Circled. [b]Illegible. [c]Interlined above.

1. Edison had built his first plate (disk) phonograph by the end of December (Doc. 1161; Vol. 17:27, Lab. [*TAEM* 4:897]). Drawings of 23 January show clockwork mechanisms for a plate phonograph that may be related to this new design, which was probably the one being built in early February (Vol. 17:37–42, Lab. [*TAEM* 4:905–11]; see Docs. 1196 and 1203).



Edison's first plate phonograph design from December 1877.



A 23 January drawing showing the clockwork mechanism for a plate phonograph.

2. The following drawing shows gear ratios and the corresponding speed reductions: The driving shaft at top, with a worm gear, turns at a relative speed of 4800. The top gear wheel, with 20 teeth on its rim, turns at 240. Its shaft has 20 teeth (as do the other two shafts below it). The second wheel's rim has 80 teeth, and turns at 60. The third wheel has 120 teeth and turns at 10. The large wheel at left has 200 teeth on its rim and turns at 1. The fan (lower left and lower right) is a governor.

3. Text is "adjustable sleeve."

4. Text is "mouthpiece adjustable," "point adjustable," and "plate."

5. John Kruesi was Edison's principal machinist. See *TAEB* 2:633 n. 6.

6. According to Jehl (1937–41, 318), George Carman did odd jobs around the laboratory. His name appears in the accounts by the end of April 1877. Cat. 1185:141–42, 247, Accts. (*TAEM* 22:617–18, 66).

7. Martin Force became a general handyman around the laboratory sometime in late 1877 or early 1878. See *TAEB* 3:534 n. 3.

-1175-

From Alfred Mayer

South Orange N. Jersey January 15th 1878.

My dear Mr Edison;

Ever since my return home[1] your marvellous invention has so occupied my brain that I can hardly collect my thoughts to carry on my work. Its results are far reaching (in science), its capabilities are immense. I cannot express my admiration of your genius better than by frankly saying that I would rather be the discoverer of your talking machine than to have made the ~~first~~ best[a] discovery of any one who has worked in Acoustics.

Professor Wright of Yale College and I are engaged on a work on Physics.[2] I am senior in the work. It is our desire and ambition to introduce into it all really worthy American work. Her~~t~~etofore we have depended in our college instruction entirely on foreign works such as Ganot, Dechenel, &c—[3] In Ganot, the work most used in this country the only mention of American work is a[b] short account of one of my discoveries—[4] which I sincerely think is far inferior to many—very many[b]—researches and discoveries of my countrymen.

I am now writing the part of the work on sound and nothing could give me greater pleasure—if it meets with your approbation—than to give a thorough account of your invention in our work on Physics.[5]

I wish to photograph ~~of~~ the instrmnt for our engraver, and I also wish several of the records engraved to accompany it.

I[b] have devised a method which will, I think, give the elevations and depressions of the traces to ¹⁄₁₀ ₀₀₀ in.

To give a thor[ou]gh account of the invention I must experiment with it for, as no one knows better than you, one cannot really understand or appreciate ~~ne~~a new experiment or apparatus ~~uti~~ ~~un~~[a] until he has drilled his hands & head to perform the experiments. Under the circumstances may I not ask the favor that you will receive from me an order for one of the new cylinder machines now making with the heavy fly wheels.[6] Surely, there is no one in the country who can appreciate your great invention more than I.

I would like the instrmt at as early[b] a day as possible because I want a month or so of experiments before I write about the instrmt in our book. If I can possess one of the instrmts then I can work at it whenever I wish.

I need not say that I shall be happy to see you whenever you will give us the pleasure of seeing you at the Stevens Institute With the highest esteem Yours very respectfully[b]

Alfred M. Mayer[7]

ALS, NjWOE, DF (*TAEM* 18:906). [a]Interlined above. [b]Obscured overwritten letters.

1. On 29 December, Edison had invited Mayer and Henry Morton, president of the Stevens Institute of Technology in Hoboken, N.J. (where Mayer was professor of physics), to visit Menlo Park; they most likely visited on 13 or 14 January. Doc. 1156 n. 1; Brown Ayres to TAE, 20 Jan. 1878, DF (*TAEM* 15:187).

2. Mayer had begun the "Experimental Science Series for Beginners" (published by D. Appleton of New York) with a volume on light coauthored with journalist Charles Barnard, but Barnard was unable to continue the partnership. Mayer then joined with Arthur Wright, professor of physics and chemistry at Yale and later director of its Sloane Physical Laboratory, to continue the series. However, Mayer published the second and last volume of the series (on sound) by himself. Mayer 1878b, 5–8; *NCAB* 13:348; *NUC Pre-1956*, s.vv. "Mayer, Alfred Marshall," and "Wright, Arthur Williams."

3. Freely edited and adapted translations of various French introductory texts and popular expositions of physics—particularly those of Adolphe Ganot, Augustin Privat-Deschanel, and to a lesser extent, Amédée Guillemin—were widely used in both the United States and the United Kingdom from the 1860s into the twentieth century. See, e.g., Atkinson 1890 and Peck 1866.

4. Ganot described Mayer's method for illustrating the reciprocal action of magnetic poles by the use of floating magnets. Atkinson 1890, 687.

5. Mayer 1878b; this included an illustrated section on the phonograph in its penultimate chapter, pp. 170–74. Beyond a basic description and explanation of the working of a cylinder tinfoil phonograph, the book contains only a very brief account of Mayer's examination of the traces recorded on the foil.

6. Doc. 1166.

7. Alfred Mayer (1836–1897) had worked as a machinist, studied chemistry, physics, physiology, and mathematics, and taught at various colleges before organizing the physics program at Stevens Institute in 1871. Mayer was noted for research in several areas of physical science, including photographs of the August 1869 solar eclipse. An essay on his career had recently been included in a *Popular Science Monthly* series featuring the most eminent contemporary European and American scientists. "Sketch of Professor Mayer," *Pop. Sci. Mo.* 10 (1876–77): 230–33; *DAB* and *DSB*, both s.v. "Mayer, Alfred Marshall."

-1176-

Charles Batchelor Diary Entry

[Menlo Park,] Tuesday Jan [15][a] 1878

Jim[1] showed telephone & phonograph at Metuchen[2] to a church

Edison, I, Johnson gave Orton[b] a test of all the telephones from 1~~68~~99 Bdway[3] Jims music came in on us Orton[b] said that Edison's instrument was the best articulation & loudest.

AD, NjWOE, Batchelor, Cat. 1233:15 (*TAEM* 90:60). [a]From preprinted diary page. [b]Obscured overwritten letters.

1. With Batchelor, James Adams was Edison's other primary experimental assistant. See *TAEM* 2:250 n. 4.

2. Metuchen is located about 4 miles south of Menlo Park on the rail line. Nothing further is known about this demonstration.

3. The official address of Western Union's headquarters building in New York City was 197 Broadway. The tests probably compared Edison's and Bell's telephones, although they may also have included Gray's and Phelps's. James MacKenzie had joined Edison and Batchelor in testing Bell's at Menlo Park two days earlier. Cat. 1233:15, Batchelor (*TAEM* 90:59).

-1177-

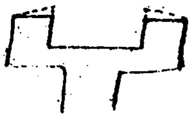
Charles Batchelor to Sigmund Bergmann

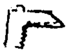
Menlo Park, N.J. Jan 19th 1878

Friend Bergmann[1]

We tested some of your receivers[2] and they had no strength at all now the faults are these:—

1 Surface of cup is not straight it is more like dotted line in this sketch they must be absolutely flat to be any good



2 Cap is not straight where it binds the diaphragm it is more like this dotted line 

this must also be absolutely flat

3 Diaphragms do not all bind tight

4 Core must be made small like sketch sent

5 Bradley spools[3] must be used

6 Your spools some of them touch the diaphragm.

7 The cores must stand perfectly straight and must be flat on the shoulder that goes next to the permanent magnet some of yours are hollow and some are round

8 Bindposts must have 10/32 thread in rubber

9 Spools must be 60 to 70 ohms

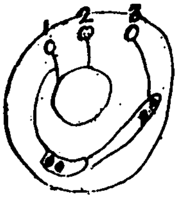
10 Your threads are slack so that when screwed down you can push the cap about 1/32 of an inch across

11 The cut out button[4] must only stand out 1/16 of an inch

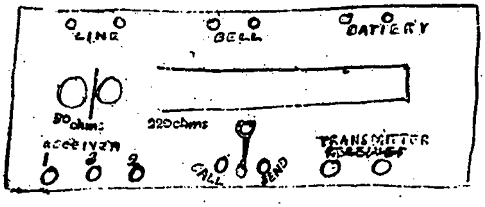
12 Diaphragm must stand 1/100 of an inch away from core

13 Tin type plates must be straight.

14 The connections I gave you for receiver were wrong[5] connect all like this and mark 1. 2. 3.[a]



15 You must nickel plate the bindposts on receiver[a]
The coils on the polarized relays must be Bradley's and (25) twenty five ohms each these are only 11½[b] each. mark the coil this way in every case



This must be stamped on the wood in every case without fail on top of the Box should be stamped 'Edison's Speaking Telegraph' No 130[6]

All these improvements you must make on the ones you have in your place as we shall have trouble if you do not[7]

If you were to get stamps cut it would pay you as no doubt you will make all coils

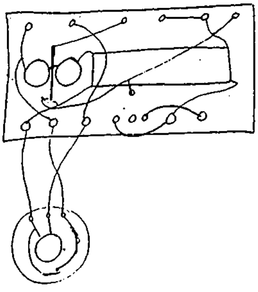
The gong on bell ought to be nickel plated for the price

Batchelor for Edison

ALS (letterpress copy), NjWOE, Lbk. 1:321 (*TAEM* 28:194). [a]Followed by centered horizontal line. [b]Circled.

1. Sigmund Bergmann had worked as a machinist in Edison's Ward St. shop in the early 1870s. In 1876 he opened his own shop on Wooster St. in New York City. See *TAEB* 1:579 n. 1.

2. Little is known of the receivers beyond this letter and the correspondence cited in note 7 below. However, they were probably a modification of the designs drawn by Batchelor on 17 and 20 December 1877. Edison's Exhibit 179-13, TI 2 (*TAEM* 11:611); Vol. 13:183, Lab. (*TAEM* 4:128). Bergmann had brought coils and bells to Menlo Park the previous day. He was then making fifty receivers; Murray was making twelve transmitters. Henry Thau was also apparently making both transmitters and receivers (Cat. 1233:18, Batchelor [*TAEM* 90:62]; Doc. 1125; Batchelor to Bergmann, 11 Jan. 1878, and Batchelor to Thau, 19 Jan. 1878, Lbk. 1:319, 325 [*TAEM* 28:192, 198]; Vol. 14:33, Lab. [*TAEM* 4:174]).



Charles Batchelor's 5 January 1878 telephone receiver circuit drawing.

3. These spools, the patented design of the late Leverett Bradley (see *TAEB* 1:141 n. 1), were being manufactured by Fitch & Meserole of New York, who also made induction coils for Edison's telephones. *TAEM-G1*, s.v. "Fitch & Meserole"; Batchelor to Bergmann & Co., 7 Feb. 1878, Lbk. 1:337 (*TAEM* 28:210).

4. This switch, which cut out the resistance of the induction coil when the user was listening, was the reason for having three wires to the receiver. It is shown in the sketch following item 14 in this document and in Edison's Exhibit 179-13, TI 2 (*TAEM* 11:611). A drawing of 12 January shows a circuit that would include such a switch (Vol. 14:14, Lab. [*TAEM* 4:161]).

5. Batchelor had sent Bergmann a drawing on 5 January. Lbk. 1:318 (*TAEM* 28:191).

6. Case 130 was Edison's first carbon-telephone patent application. It was one of several telephone applications that became part of the Telephone Interferences (Doc. 1270), and did not issue as U.S. Patent 474,230 until 3 May 1892.

7. For other alterations made to these instruments see Vol. 4:34 (*TAEM* 4:175) and Batchelor to Bergmann or Bergmann & Co., 11, 20, 22, 23, 26, 31 Jan. and 7, 27 Feb. 1878, Lbk. 1:319, 326–30, 333, 337, 379 (*TAEM* 28:192, 199–203, 206, 210, 243).

-1178-

Charles Batchelor Diary Entry

[Menlo Park,] Saturday Jan 19th 187~~7~~8

Edison, wife,[1] I and Rosa[2] went to see Heller.[3] Worked on Phonograph & telephone all day.

AD, NjWOE, Batchelor, Cat. 1233:19 (*TAEM* 90:62).

1. Mary Stilwell Edison, who had married Edison on 25 December 1871. See *TAEB* 1:385 n. 5.

2. Batchelor's wife.

3. "Heller's Wonders," featuring the "brilliant and astounding specimens of necromancy and diablerie" of the eminent magician and musician Robert Heller (the stage name of William Henry Palmer, an Englishman billed as American) and the "gift of second sight" of Haidee Heller (billed as his sister), was running on Broadway at the Fifth Avenue Hall (next to the Fifth Avenue Hotel) (advertisement, *New York Herald,* 18 Jan. 1878, p. 1). Edison commented a few weeks later that "his tricks are very good and very smart, but I figured out all of them excepting one. The 'second-sight' is the thinnest of all" ("That Wonderful Edison," *New York World,* 29 Mar. 1878, Cat. 1240, item 463, Batchelor [*TAEM* 94:147]). See also "The Mystery of Second Sight," *New York Sun,* 9 Feb. 1878, Cat. 1240, item 354, Batchelor (*TAEM* 94:108); Christopher 1973, 211–12; Doerflinger 1977, 15; and Mulholland 1935, 34–38.

-1179-

From Edward Johnson

NYork Jan 20/78

Dr E

In looking over my Pocket Contents b4 leaving I find enclosed note from Painter on Telescopes— You can undoubtedly get a better one in this way for the amount you want to pay than by having it made

U.H. tells me to remind you of our Telephone bargain Please dont settle upon your terms with W.U. till you have given us a chance to do our part. The Bell Co clearly think if they had yours they would have a monopoly & would quickly suppress the shysters Think twice about this & write me to Dunkirk[1] that you will at least keep me so advised that I can get you a clean Bonafide offer for it before you give your final consent to the W.U.'s terms— Lets see if they will pay you once at least a reasonable price for your product.

See notice of Feby Phrenological Journal in last nights Graphic "Benefactor of your race"—[2] See also in same paper Communication from "Perhaps" on Quadruplex.[3] Also in Fridays Graphic Editorial on Phonograph[4a]

Get Feby Phrenological— Yours

Johnson

ENCLOSURE[b]

WASHINGTON, D.C. JAN 16 1878[c]

My Dr J

I enclose the address of the man[5] who has a big 4 inch Telscope Equatorialy mounted[6] he will sell for 260 to $300 (worth 6 to 700) & he knows of a man who has a six inch one that he will sell for $400 or possibly little less—both are cheap if in good order— Tell Edison I think Phngph Pat[d] will be put thro next week if he comes over— It is being pushed OK[7]

UHP

ALS, NjWOE, DF (*TAEM* 15:189). [a]Followed by centered horizontal line. [b]Enclosure is an ALS. [c]Place and date from *Philadelphia Inquirer* handstamp. [d]Interlined above.

1. See Doc. 1184.

2. The 19 January issue of the *New York Daily Graphic* printed an endorsement for the February *Phrenological Journal*, which contained a biographical sketch, "Thomas A. Edison, The Electrician and Inventor." Cat. 1240, items 329, 352, Batchelor (*TAEM* 94:100, 105).

3. "The Quadruplex Tangle," questioning the delayed verdict in *Atlantic & Pacific v. Prescott & others*, appeared in the 19 January issue of the *New York Daily Graphic*. Cat. 1240, item 333, Batchelor (*TAEM* 94:100); on the trial, see *TAEB* 3, chap. 5 passim.

4. An editorial in the *New York Daily Graphic* of 18 January (p. 514) discussed an exhibition of the phonograph at the Cooper Union in New York.

> Several snatches of songs were committed to the machine in a high key, and afterwards repeated to the bystanders with much fidelity. The inventor believes that the phonograph will yet be so matured and developed that it can receive and record the songs of popular opera-singers and then reproduce, *ad libitum,* their very voices and words with all their emotional power.

Johnson directed the exhibition before some three hundred people attending a meeting of the Polytechnic Institute. Edison helped operate the instruments, which included his musical and speaking telephones, and Batchelor was also present. "Transmitting Speech and Song," *New York Tribune,* and "Preserving Sound," *New York Herald,* both 18 Jan. 1878, Cat. 1240, items 330, 334; Cat. 1233:17; all Batchelor (*TAEM* 94:100; 90:61).

5. Unidentified; the enclosure has not been found.

6. That is, mounted on an axis that can be set perpendicular to the equatorial plane. This allows a simple clockwork drive to supply the motion necessary to counter the Earth's rotation.

7. See Doc. 1183 n. 4.

-1180-

From George Bliss

CHICAGO Jany 21 187~~7~~8[a]

Dear Sir:

I am sorry the Painter crowd has cleaned me out on the Phonograph. That is what a man gets when he does not stay and attend to business. I want it understood that they could not have done this if you had given me a Phonograph to work with. It is such an incredulous thing that people wont believe it except on sight. If the dicker with me has got you a good bargain I am satisfied. I knew nothing about the Painter option till today. This thing places me in rather a bad fix with parties to whom pledges have been made in my new company.[1] I feel like giving up ambition and settling down to a quiet Electric Pen life. There is enough in that if economically managed to satisfied an ordinary man. Shall be glad to get a Phonograph to show up to the curiosity seekers. Since the Western Electric received such large orders for Gray telephones[2] I began to think Wm Orton did not know a good thing when he heard it. It seems he does after all. Barton has written quite favorably of the sending part of your telephone but he is rather sour since the order for battery telephones[3] was countermanded. He ought to be satisfied for there is an abundance of work on the magneto telephones[4] ordered. Three letters in from Beetle today. I find it hard work to convince him that Herz is [—][b] a fraud. Herz still claims you have treated him shamefully—Says he is willing to pay the money when perfect telephones arrive.[5] Beetle claims Herz stands well with Preece (who[c] agrees that your conduct is shameful) also with many French officials high in authority. Beetle says Herz threatens an injunction &c. Field came back because he found that Herz was paying his bills with drafts on banks where he had no money. That man will hang himself in time. I wrote Beetle a few days since to get entirely clear from him. Beetle's Frenchman[c] has not come to [terms?][c] yet & paid the money for the first 150 outfits & the French Gen'l agency. He expects to focuss the matter very soon. Parties are troubling Beetle with pneumatic, clock-work & other pens. What is the state of your foreign patents on these outside methods?[6] Beetle is closing contract for 50 pens for Portugal. He has had a tremendous row with the London Co. over Spain. They were about taking out a patent. Beetle has a party who will probably take Spain buying 300 outfits at once, 175 of which are for the government providing you will proteçt with a patent. Let me know what my recognition in the Phonograph is? Please see letter written to Mr. Serrell about Spanish patent within a day or two.[7] Respectfully

Geo. H. Bliss Gen'l Man.

ALS, NjWOE, DF (*TAEM* 15:194). Letterhead of Electric Pen and Duplicating Press; letterhead and dateline are electric pen copy. [a]"CHICAGO" and "1877" preprinted. [b]Canceled. [c]Obscured overwritten letter.

1. One of the persons who may have been involved in this proposed new company was Bernard Bigsby, apparently an agent for the electric pen (see Charles Batchelor to Bigsby, 22 Mar. 1876, Lbk. 2:67 [*TAEM* 28:402]). Soon after this letter from Bliss, Bigsby wrote to Edison:

> Bliss drops a tear over the loss of the Phonograph and I believe in his heart of hearts thinks that I am at the bottom of it all—if I could have raised stock in time for you— if—but you know what if means. If I had only had the brains to invent the Phonograph no fifteen per cent would ever have tempted me to sell my birth-right. You have out Esaued Esau. You have killed a goose that would lay a dozen golden eggs every day of your life. I should have wanted at least a hundred thousand down and twenty per cent as long as the patent lasted and I should have got it. [Undated, DF (*TAEM* 16:570)]

Bigsby hoped to get a phonograph for exhibition purposes and also to write a biography of Edison. Although Bigsby offered him half the receipts after expenses from any exhibitions, Edison provided neither phonograph nor biographical material. Upon learning that Edward Johnson had been put in charge of the exhibition business, Bigsby wrote Edison that he was "very much disappointed at your treatment of me which is not generous. I suppose however your mind is too occupied to give heed to the ordinary courtesies of common life" (19 Mar. 1878, DF [*TAEM* 18:950]).

2. Doc. 1124.

3. In Elisha Gray's battery telephone the current varied as the diaphragm vibrated next to a polarized magnet charged by a local battery. Prescott 1878c, 31–33.

4. Gray's magneto telephone, which worked on the same principle as Alexander Graham Bell's, had two diaphragms placed at opposite poles of a U-shaped permanent magnet. Prescott 1878c, 33.

5. Cornelius Herz and Stephen Field had arranged in September 1877 to acquire one-ninth of Bliss's one-fifth rights to Edison's telephone patents for Russia, Spain, Italy, Austria-Hungary, Germany, France, and Belgium, and to pay the costs of those patents. They did not pay, however, and in December Edison signed a new contract with Bliss and Theodore Puskas that replaced his original agreement with Bliss. Docs. 1056, 1204, 1212; *TAEB* 3:678 n. 5.

6. Besides a variety of alternative electric motors, Edison had included foot-treadle, pulley, and water-power designs in the basic foreign patent he took out for his electric-pen copying system in Great Britain, France, and Belgium (Brit. Pat. 3,762 [1875], French Pat. 112,719, and Belgian Pat. 39,502). Although he included a pneumatic drive in his U.S. Patent 205,370, Edison did not patent this in Europe.

7. The letter has not been found; see Doc. 1169 n. 2.

-1181-

To Uriah Painter

[Menlo Park,] Jany 23/78

U.H.P=

To poor to buy a luxurious Telescope just at present but may soon do so if phono turns out well= Articulation on phono very much improved for music of every kind it is now perfect= for Dictating there is only the defect of being compelled to talk a little loud= this can be got over. You ought to have a Contract with me in regard to that 5 per cent=[1] We must take care of Bliss. Yrs

Edison

ALS, PHi, UHP.

1. Painter's percentage for negotiating the phonograph contract. Doc. 1190.

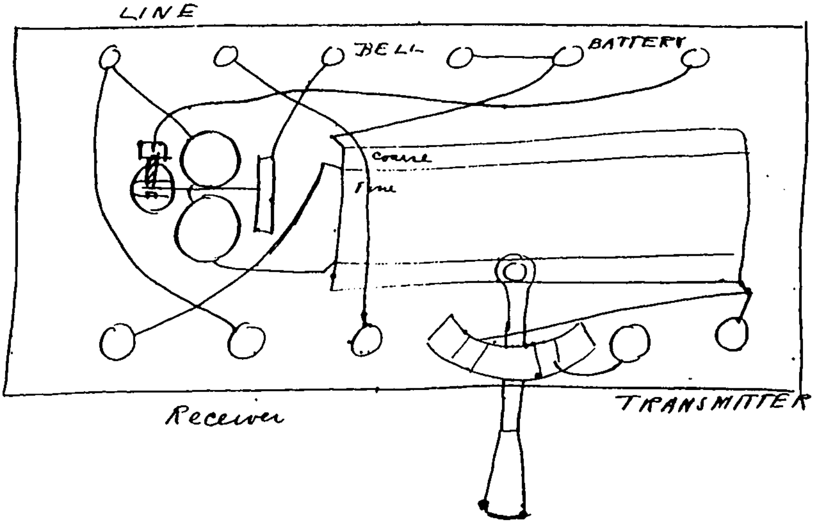
-1182-

Charles Batchelor Memorandum: Apparatus for Theodore Puskas

[Menlo Park,] Jan 23 1878

Speaking telephone

The coils taken by T. Puskus Esq to Paris[1] were connected up so:—



Outfit Sent: =

One. 1[a] Phonograph. He took another Phonograph from his house[2b]
4 four Watson Batteries[3]
200 two hundred feet twisted kerite wire.[4]
50 fifty feet of Kerite wire
2 two transmitters (Batchelor's make)[5]
2 two receivers (1½ in diameter) no cut out.
    one Batchelor make new pattern
    one Bergman altered over[6c]
2 two Bergman Bells
2 two Bergman coils altered to above sketch[7]
4 four Double conductor cords

⟨Sailed on 'Cimbria' Hamburgh Line for[b] Cherbourg, France⟩[8d]

Chas Batchelor

ADS, NjWOE, Lab., Vol. 14:17 (*TAEM* 4:164). Written by Batchelor. [a]All initial numerals are circled. [b]Followed by centered horizontal line. [c]This and preceding line spanned by brace at left. [d]Marginalia written by Batchelor; preceded and followed by centered horizontal line.

1. The previous day Puskas had visited Menlo Park "to try his telephones." Cat. 1233:22, Batchelor (*TAEM* 90:64).

2. At least one of these was one of the first flywheel phonographs (Doc. 1166); the details of the other are unknown.

3. This copper sulphate battery, patented by J. E. Watson in June 1876 (U.S. Pat. 178,215), was sold by L. G. Tillotson & Co. *Operator,* 1 Nov. 1876, 12.

4. Kerite-insulated wire was widely used in telegraphy. Kerite, invented by Austin Day, was a rubber-like substance formed from a com-

bination of tar and vegetable oil vulcanized by sulphur. Knight 1877, s.vv. "Kerite," "Kerite Wire."

5. These transmitters may be like those in Doc. 1125.

6. See Doc. 1177.

7. The previous day Batchelor had written, "We find we cannot work the polarized relay in that position" (that is, with the tongue vertical). He sent a sketch of the new arrangment (with the tongue horizontal), similar to the one in this memorandum, and indicated that he had changed six of them. Batchelor to Bergmann, 22 Jan. 1878, Lbk. 1:328 (*TAEM* 28:201).

8. Puskas sailed the following day. Cat. 1233:24, Batchelor (*TAEM* 90:65).

-1183-

From Uriah Painter

WASHINGTON, D.C. JAN 26 1878[a]

My Dr E—

Yours of 1–23 to hand—

Mc'Cormick says he has assigned you the 25 × 25 asked for—[1]

If I had known you cared for a Telescope I would have given you one I had. I got tired of it—had no use for it & asked Johnson one day if you ever had any use for one & he said not, you were on the practical lay, so when I went to work to raise the 10,000 for you[2] & found I must start it with my own money[b], I set to work to selling my loose things & let the telescope go for $200.# but I find I can get a much superior one in Jersey City for $300, & will see that you get one that dont cost you a cent—only give me a little time on it—[3]

I would have your Phono. Pat out last week if Serrell had replied promptly to Dep't & fixed his papers OK—[4] Now if you will drive him up I can get it out so it will date Feby 5— It is now too late for Jany 29—

When[c] will you be ready to come over here with your Phono[c]—? The ten is ready to be paid over I[d] dont know why there is so much delay on papers—

The WU folks here are blowing big now on Grays Telephone— I thought it had fizzled out long ago— The Phelps bastard, at the Pat ofs works at first but soon grows faint so it cant be heard—[5]

Pope[6] is red hot after some patents he is trying to get out for Smith on Duplex![7]

We will do the right thing on Bliss[c] & decide on it when you come over— I see by his letter he has not got any party yet! Wants 30 days & 2 machines to show to start on![8] several of my men put up before they saw it, two[c] here not even seen it yet! I see by[f] papers that Johnson made hit with Phono at Elmira—[9]

Have you tried to buy out JCR yet?[10] Yrs

U H Painter

ALS, NjWOE, DF (*TAEM* 15:197). [a]Place and date from *Philadelphia Inquirer* handstamp. [b]"with . . . money" interlined above. [c]Obscured overwritten letter. [d]Overwritten dash. [e]Also interlined above in another hand, possibly by Edison. [f]Interlined above.

1. That is, a 25-foot-square exhibition space at the upcoming Universal Exposition in Paris.

2. See Doc. 1158.

3. In May 1878, Edison borrowed a telescope from Prof. Asahel Eaton, a Brooklyn chemist and manufacturer of optical instruments (see Doc. 1312 n. 1). He and Eaton had discussed the possibility of Eaton's making a telescope for Edison in 1877, and they continued to correspond about this matter through the summer of 1879. *TAEM-G1–2,* s.v. "Eaton, Asahel K."

4. The Patent Office did not notify Lemuel Serrell concerning problems with Edison's application until 26 January. Serrell responded on 4 February, Painter paid the final fee on 15 February, and U.S. Patent 200,521 issued on 19 February. Because he had not handled the final payment, Serrell was surprised when the patent issued and wrote Edison, "I presume the faries must have paid it in, so as to have the privilege of recording their communications!!" H. C. Townsend to TAE, 26 Jan. 1878, and TAE to Commissioner of Patents, 4 Feb. 1878, both Pat. App. 200,251; receipt to Uriah Painter, 15 Feb. 1878, and Serrell to TAE, 6 Mar. 1878, both DF (*TAEM* 18:629, 634).

5. It is not clear whether Painter is referring to a patent application or an exhibition of George Phelps's telephone at the Patent Office in Washington, D.C.

6. Franklin Pope, Edison's former business partner and a prominent electrical engineer and inventor, was at this time in charge of Western Union's patent department. See *TAEB* 1:115 n. 1.

7. Gerritt Smith was the assistant electrician at Western Union who helped install the quadruplex on Western Union lines. He received several quadruplex patents, including some that Edison believed were his designs. See *TAEB* 2:353 n. 3, 359 n. 4.

8. See Docs. 1172 and 1180.

9. See Doc. 1184. The 22 January issue of the *Elmira Advertiser* ran a story on the "Telephone Entertainment Last Evening" which described Johnson's lecture and demonstration of the Edison Musical Telephone. Cat. 1031:2, Scraps. (*TAEM* 27:733).

10. See Docs. 1168 and 1191.

-1184-

Edward Johnson to Uriah Painter

Jamestown NYork Jany 27th 1878

My Dr. U. H.

I have given a concert every night the past week[1] Each time in a different town sometimes many miles apart

Monday	Elmira	NY
Tuesday	Courtland	"
Wednesday	Homer	"
Thursday	Dunkirk	"
Friday	Fredonia	"
Saturday	Jamestown	"[a]
Monday next.	Warren	Pa
Tuesday & Wednesday		Blank
Thursday	Lockport	N.Y.

From Warren Pa to Lockport N.Y. (between Buffalo & Niagara falls) is a long jump— Else we could give us one at Titusville Pa—

Utica N.Y. is after me too but I am so anxious about the Phonograph & Telephone matters in NY that I shall postpone everything till I pay a visit to NYork—

I have been paid for all my concerts promptly though they have not been pecuniarily successful to the managers— At Elmira & Courtland it was a decided success at the other places a trifling loss was effected. At Warren Monday it is expected it will be a great success. At all places great enthusiasm is shown over both the Telephone and the Phonograph, but the great applause—the climax—is always reached when the Phonograph first speaks I find the general impression is the same hereabouts as elsewhere that a Telephone concert cannot be heard. Bells man[2] has been through here, & is pronounced a humbug They say he occupies some 45 minutes in explaining the Instrument (which I do in 5) & then no one knows what it is after wards I am receiving my usual compliments in respect to lucidness of my explanations No daily[b] papers published in Courtland Homer Dunkirk or Fredonia Hence no report as yet from there. I will have a Jamestown paper tomorrow & a Warren paper Tuesday—will send you copy of both.[3] Everybody talks Phonograph the day after the concert and all agree that a 2nd concert would be more successful than the first.

If you get this before Thursday wish you would Telegraph me briefly whether things are O.K. If the money has been paid to Edison say—All O.K. If not, but everything all going on smoothly and no hitches say simply O.K. If any hitch which indicates a possible rupture say delayed If busted say Dam—no—Done[a]

I have not heard a word from NYork since I left. I am using Bells speaker instead of the Morse for directing my singers—last night used it 26 miles—Jamestown to Warren—very successfully It attracts a great deal of attention—and I foster it— I treat it with fairness, & ~~j~~shall justify myself to the WU & Edison on the ground that my entertainment is a scientific one & not an advertisement and that I have suffered great inconvenience & loss by Edisons failure to supply me with a set of speakers which he might easily have done this time—but he has never yet shown a proper appreciation of the ~~work~~[a] good[c] I am doing him. He promised me the 3rd Phonograph of those 3 he was making[4] & at the last moment went back on me & sent me off with the old one—

You should hear me bring down the House by my singing in the Phonograph when I fail to get a Volunteer— I tell them I cannot sing but if they will promise not to communicate the fact to my wife rather than have them disappointed I will myself sing a song in it. The effect when they hear me is stupendous, but when they hear the Phonograph reproducing my song with all its imperfections they endanger the walls with the clamor I then tell them they have negative proof that it will reproduce song—the whole thing proving the happiest possible exhibition of the work of the Instrument.

The By word we invariably leave behind us is "Hello! Hello![5] How do you get it" It is[b] fortunate I brought a[d] man[6] with me else I never could have got along. The extra expense however will reduce my profits very considerably I expect however to get home with about $250. clear Shall reach NYork Feby 2nd[7] Yours

E H. Johnson

ALS, PHi, UHP. [a]Followed by centered horizontal line. [b]Interlined above. [c]Interlined below. [d]Obscured overwritten letters.

[1] Johnson wrote this on a Sunday.

[2] Unidentified.

[3] Not found.

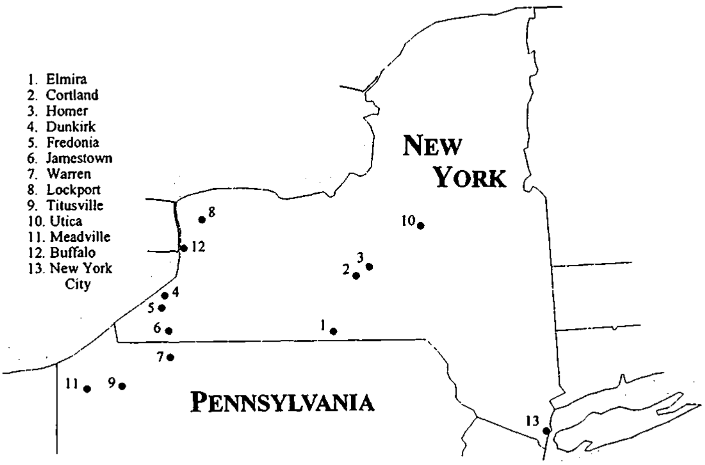
[4] See headnote p. 10.

[5] In his autobiographical reminiscences Edison claimed that he invented the use of "Hello" for the telephone (see *TAEB* 3, App. 1.D304). Allen Koenigsberg (1987, 3–9) concludes that Edison was indeed the first to use "Hello" (Alexander Graham Bell preferred "Ahoy").

[6] Unidentified.

[7] See Doc. 1193.

Towns where Edward Johnson exhibited telephones and the phonograph in late January and early February 1878; Buffalo and New York City also shown for reference.


1. Elmira
2. Cortland
3. Homer
4. Dunkirk
5. Fredonia
6. Jamestown
7. Warren
8. Lockport
9. Titusville
10. Utica
11. Meadville
12. Buffalo
13. New York City
NEW YORK
PENNSYLVANIA
1
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8
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-1185-

From Joseph Murray

Newark, N.J., Jan 28 1878[a]

Sir

I will go with you to Mr Orton tell him same as I told you and Mr Miller[1] it will do no good to state it on paper and have it going round the building for each one will be very likely to deny it— but you must know how Ashley[2] and Pope feel to you also Scott[3] Phelps Smith and Prescott Each one are no friend to you and I told you except Mr Orton you have not one friend in the W.U Co and when Eckert[4] is added the ring will be complete and you cannot expect Justice from them I am Truly yours

J T Murray[5]

I want some money for Tom[6] and Jim[7] They are very needy—

ALS, NjWOE, DF (*TAEM* 15:201). Letterhead of J. T. Murray. [a]"Newark, N.J.," and "187" preprinted.

[1] Nothing else is known of this conversation. Norman Miller, long associated with Edison through the Gold and Stock Telegraph Co., had overseen the operations of the electric pen business from early October 1875 to mid-January 1876 (see *TAEB* 1:513 and Doc. 639). Josiah Reiff also wrote Edison on 28 January to warn him about the machinations of Western Union officials:

> Even if O[rton] feels kindly personally, he will gladly avail of every assault made by Phelps, Prescott, Ashley, Pope, Smith & Co to belittle your claims— Recollect you make a fatal mistake in bringing over any partially completed things—they simply tear it to pieces & experiment upon you. You simply furnish brains for them & they are your inveterate foes, unless you fill their pockets without consideration. [DF (*TAEM* 19:461)]

[2] James Ashley, editor of the *Journal of the Telegraph,* and Franklin Pope had been Edison's business partners from the fall of 1869 through the spring of 1870. After their falling out they attacked Edison's professional reputation and personal integrity. See *TAEB* 1:137 n. 2; 2:305–7.

[3] George Scott was general superintendent of Gold and Stock. See *TAEB* 1:297 n. 7.

[4] Thomas Eckert was president of the Atlantic and Pacific Telegraph Co. Western Union and Atlantic and Pacific had merged the previous summer, and it was generally expected that Eckert would be made Western Union's general manager. When Jay Gould later formed a competing company, the American Union Telegraph Co., he placed Eckert in charge. See *TAEB* 2:120 n. 6; 3:472 n. 1; Gould's testimony, U.S. Senate 1885, 1069.

[5] Joseph Murray had been Edison's manufacturing partner between 1872 and 1875, after which he established his own firm and continued to make instruments for Edison. At this time Murray was manufacturing Edison's telephone transmitters. See *TAEB* 1:282 n. 1, 3:642 n. 1.

[6] Unidentified; probably one of Murray's workmen.

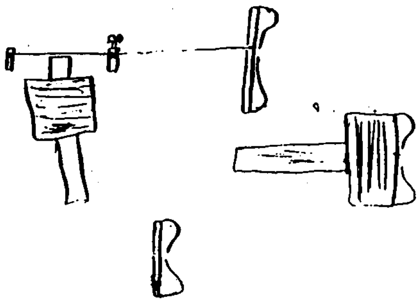
[7] Probably James Bradley, who had worked as a machinist for Edison and Murray and was still working for Murray in the manufacture of Edison's telephone transmitters. See *TAEB* 3:589 n. 4.

-1186-

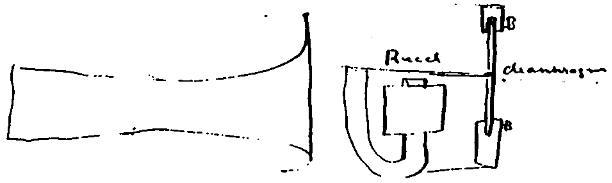
Technical Note: Telephony

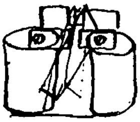
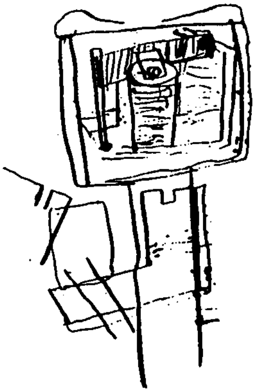
[Menlo Park,] Jany 28th 1878[1]

Speaking telephone

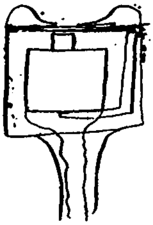


String or Iron strip[2]

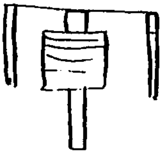


Polarized relay strip of tin between the magnet fastened at both ends Mica diaphragm



Mica diaphragm next the core and Iron one over it gives the best talking yet



Copper core & copper diaphragm

James Adams

X, NjWOE, Lab., Vol. 14:31 (*TAEM* 4:172). Written by Adams; document multiply signed and dated.

1. This technical note represents work on telephone receivers between 26 and 28 January, all recorded by Adams. Vol. 14:23–32, Lab. (*TAEM* 4:170–73).

2. Text is "Reed" and "diaphragm." Edison had used a curved polarized relay to modify a Bell telephone in September 1877 (Doc. 1062).

-1187-

Technical Note: Phonograph

[Menlo Park,] Jany 29 1878

Phono—[1]

I propose as an alarm for various uses to have bands, cylinders or discs drilled stamped cast etc with fine holes ~~eq~~ around them very close together having the appearance of a musical note on the phono— The holes however deeper— a spring with point follows in & out of these holes= Spring is connected to a diaphragm or Sounding board drum etc. The quick rotation of the plate etc causes the spring to set[a] the diaphragm in motion producing a powerful, high, and piercing scream or note. to trill it I propose to skip[a] every 3 4 or 5 dot & can also have several springs & several Rows[a] of holes like an index plate[2] Springs working separate diaphragms or one diaphragm This will give a composite tone=

// Batch just tried it its ok, loud

T A Edison
~~J Kruesi~~

Chas Batchelor
~~G E Carman~~
~~M. N. Force~~

X, NjWOE, Lab., Vol. 17:45 (*TAEM* 4:914). [a]Obscured overwritten letter.

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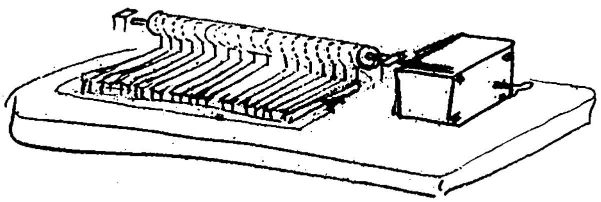
[1] In addition to developing exhibition and dictating phonographs, Edison also contemplated other possible applications. For instance, he considered developing a children's piano with prerecorded notes, and he envisioned an instrument with individual keys to play each letter of the alphabet. Vol. 17:43, Lab. (*TAEM* 4:912); Doc. 1277.

[2] A circular plate used to guide a machine tool in the making of gears, graduated circles, etc.

Edison's phonographic "children's piano."



-1188-

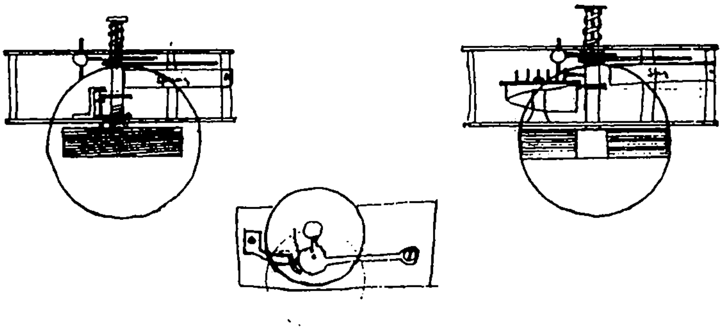
Notebook Entry: Phonograph

[Menlo Park,] Jan 29 1878

Phonograph.

Whilst Edison and I were experimenting at Ansonia, Conn.[1] with the Phonograph in order to apply it to speaking clocks we found out that soft rolled copper answered excellently for recording in place of tinfoil and although the indents could hardly be seen in some cases, it came out clear and louder than ever before;[2] of course with copper we could use a stiffer spring[3] and have it more rigid on the diaphragm than when we used tinfoil.

I designed three different ways of applying it in place of the striking attachment for clocks[4]



Chas Batchelor.

X, NjWOE, Batchelor, Cat. 1317:53 (*TAEM* 90:683). Written by Batchelor.

1. Batchelor and Edison traveled to Ansonia on the 29th with James James and Henry Davies to see the Ansonia Clock Co. and Ansonia Brass & Copper Co. factories. They worked on the phonograph until 4 A.M. the next morning and Batchelor noted in his diary that they "got best talking on copper instead of tinfoil." They continued their experiments on the 30th and returned home that night. Cat. 1233:29–30, Batchelor (*TAEM* 90:67–68).

2. Sometime that spring Batchelor showed a reporter for the *Brooklyn Daily Times* "a piece of sheet copper, fully one-thirtieth of an inch thick which had been wrapped around the cylinder." After recording the sound of a music box, "a microscope of four hundred diameters, failed to detect the slightest marks; and yet the phonograph gave back that music so clearly that it was heard distinctly at a distance of three hundred feet." In court testimony Batchelor indicated that they used the music-box to get "a vibration that was purely a vibration" without the "wind rushes from the mouth . . . . If we wanted to know whether we were reproducing the very smallest vibration, we would always try it with the music-box, after having experimented with speech." "Two Hours With Edison," Cat. 1029:73, Scraps. (*TAEM* 25:197); Batchelor's testimony, p. 594, *American Graphophone v. U. S. Phonograph* (*TAEM* 116:371).

3. In the recording/playback assembly. See Doc. 1166.

4. For further work on clock phonographs see Doc. 1216.

-1189-

From George Bliss

CHICAGO Jan'y 30 18~~7~~8[a]

Dear Sir:

Yours of 27th at hand.[1] Am delighted to hear that the Rotary is so near out. Engelman writes me that his steam press is about finished and he is immensely pleased.[2] I want to knock the wind out of him with the Rotary. Please advise me how it performs when set up. Glad you are not forgetting me altogether on the Phonograph and shall be pleased to hear particulars when you can send them. Gray & Barton have both just returned. You can depend on a good lift ~~in~~on royalty account in Feb'y.[3] I will, however, bring up the subject within a few days and bring things to time— You don't want to be hasty in this matter. It will be hard to find a channel where your royalty will be more safe & certain. I am confident my Pen Company will go through and if it does shall be in shape to discount your orders on the W.E— I have put in a years hard work on the Pen business & dont propose to lose it and the considerable amount of money expected. The business looks very promising to me— I coincide entirely in your judgment about Puskas. He is bound to turn out well. Herz is cutting a great swell on the other side. He was nearly busted for funds but made a scoop in some way & is living in style at Paris. He claims to have secured the Jablokoff light & Gramme Machine for the U.S.—[4] I am disgusted with Beetle who seems to be infatuated with Herz— Gen'l Stager says Herz swindled everybody at San Francisco and that he dont dare to return there. I have written Beetle if he wants to keep out of prison to cut Herz. The telephones on which the West'n Union suspended the order are the Gray Battery double coil inst's—those to be made are the Edison, Bell, Gray, Phelps' magneto telephones—made after some kinks which Gray considers good. He claims to have the foundation for all telephones &c. You have got more space than I expected at the Exposition. What shape is it in? Please send me diagram. If I am to run it let me know just what you intend to exhibit so I can be thinking up a plan to be agreed upon when ~~we~~I come down.[5] Will have Beetle get copy of French patent. Respfly

G. H. Bliss G.M.

Dont fret about royalty and you will be surprised by handsome remittance shortly! When will my Phonograph arrive?[6]

ALS, NjWOE, DF (*TAEM* 15:203). Letterhead of Electric Pen and Duplicating Press; letterhead and dateline are electric pen copy. [a]"CHICAGO" and "1877" preprinted.

1. Not found.

2. Nothing is known of Engelman. On 20 February, Bliss wrote to Edison, "Engelmann writes that he has his press in operation and that it is doing satisfactory work. Meanwhile I am without a fast press and no information at hand when I shall be in shape to offer one. How does the rotary press come on and what can I expect or promise." The next month, Bliss reported to Edison "I saw Engelmann's press in Phila. He has a level bed and the frame which holds the stencil moves back & forth under three rollers arranged with springs to vary pressure." The press worked by steam or foot power and could produce about 1,200 copies an hour. "I hope you will crowd that rotary press along. There is money in it for you and it will be the making of the Pen business." Bliss to TAE, 20 Feb. and 30 Mar. 1878, DF (*TAEM* 18:275, 15:427).

3. Ten days later Western Electric sent Edison a check for $200. Barton to TAE, 9 Feb. 1878, DF (*TAEM* 18:267).

4. Cornelius Herz and Stephen Field traveled to Paris the previous fall to acquire the Jablochkoff carbon arc light, which was usually powered by a Gramme dynamo. Doc. 970; *TAEB* 2:13 n. 2; and see Doc. 1595.

5. On 10 February, Edison wrote Bliss about taking charge of Edison's exhibit at the Exposition. Bliss to TAE, 14 Feb. 1878, DF (*TAEM* 15:237).

6. Two months later, Edison wrote to Francis Jones, secretary of the American Electrical Society, "Bliss has been after me for a phonograph for some time but I had to stop making them the demand became so great I have placed the whole thing in the hands of the Phonograph Co Room 28 Tribune bldg NYork. They will not permit me to send any more out Bliss will explain why I cannot send any." Marginalia on Jones to TAE, 26 Mar. 1878, DF (*TAEM* 15:407).

-1190-

Agreement with Gardiner Hubbard, George Bradley, Charles Cheever, Hilborne Roosevelt, and Uriah Painter

[New York?,] January 30, 1878[1a]

This memorandum of agreement entered into this Thirtieth day of January, Eighteen Hundred and Seventy Eight by and[b] between Thomas A Edison, of Menlo Park Middlesex County State of New Jersey, party of the first part and Gardiner G. Hubbard of Boston, State of Massachusetts, G. L Bradley[2] of Providence, State of Rhode Island, Chas A Cheever of the City County and State of New York, Hilbourne L Rosevelt[3] of the City County and State of New York, and U H Painter of Washington, District of Columbia,[4] parties of the second part.

Witnesseth:—

whereas the said party of the ~~see~~first part is the inventor of a new method for recording and reproducing therefrom the human voice and other sounds by causing such sounds to vibrate a mobile body the movements of which are recorded by indentation, displacement, subtraction from, ~~a~~ or[c] deposit upon any material[5] and the reproduction[6] of the movements of such mobile body by causing its record or a copy thereof to give motion to another or the same body and which is more particularly set forth in the specifications of his patent for which he did apply for in the United States Patent Office December 15th 1877[7] and— whereas the said parties of the second part are desirious of engaging in the business of manufacturing or having manufactured and selling within the United States of America the Phonographic apparatus and method invented by the party of the first part for every purpose to which it can or may be applied except to Watches Clocks, Toys of every description[8]

Therefore be it agreed that for and in consideration of the sum of Ten Thousand Dollars in hand paid to the said party of the first part the receipt of which is hereby acknowledged and for other and further valuable considerations stipulations and agreements hereinafter set forth: The said Edison grants to the said parties of the second part collectively but not individually the sole and exclusive license and right to manufacture or cause to be manufactured and sell within the United States of America only and for consumption and use in the United States of America only and not for export, consumption or use in any foreign Country. The phonetic apparatus covered by the application dated December 15, 1877 as herein set forth, for every purpose to which it may be applied except Clocks and Watches and Toys, certain rights and licenses to manufacture and sell within the United States the said invention of the said party, of the first part when applied to Clocks and watches having previous to this contract been granted by the said Edison jointly to Daniel N Somers[9] of the City County and State of New York and H J Davies[10] of Brooklyn, Kings County State of New York a copy of which contract is hereto annexed and certain rights and liceneses to manufacture and sell within the United States the Phonetic apparatus of the said Edison when applied to Toys for the use of Children granted by the said Edison to Oliver D Russell[11] of the City County and State of New York previous to this contract a copy of which is also hereto annexed, which contracts rights and licenses the said parties of the second part hereby agree to except[12] from and recognise as not herein granted to them the said right and licenses hereby granted to the said parties of the second part and this contract is to continue during the existence of the patent providing however that the said parties of the second part do separately or collectively within one year from the date hereof furnish for the purpose of the said business a capital of not less than Fifty Thousand Dollars to be used for the sole object of manufacturing and selling the Phonographic apparatus of the said Edison within the United States and to build up a permanent business in the manufacture and sale of such apparatus and the parties of the second part shall will[13] and truly pay to the said Edison twenty per cent on the actual selling price of all apparatus or articles made sold or delivered and shall make true and correct returns under oath on or before the fifteenth day of each and every month of all sales of such apparatus made and sold or delivered during the previous month and allow the said Edison to have access to the Books and accounts at all reasonable times. It is expressly agreed and understood by the said parties of the second part that the main consideration to the said Edison in this contract is the twenty per cent royalty on the actual selling price of all apparatus containing the phonetic invention[14] of the said Edison to be paid by them the said parties of the second part to the said party of the first part promptly and at the time herein mentioned and that the sum of Ten Thousand Dollars paid to the said Edison is the consideration to the said Edison to enter into this contract and grant the exclusive privileges herein set forth to the said parties of the second part

It is known[15] understood and agreed that the said sum of Ten Thousand Dollars is to be used by the said Edison to perfect the said Phonographic invention so as to render it of great practical value for many uses such as the reproduction of speeches and musical compositions. If the said Edison shall not within one year from the date hereof succeed in so developing and perfecting a satisfactory apparatus for dictating letters or reproducing musical compositions then and in that case the parties of the second part shall have the privilege of terminating this agreement upon written notice to the party of the first part to that effect and this agreement shall then cease and become null and void providing the said Edison shall at the time of receiving said notice or within fifteen days thereafter pay to the party of the second part the sum of Eight Thousand Dollars ($8000) In the event of the said Edison upon such notice failing to pay the Eight Thousand Dollars as herein above stated then and in that case this agreement shall continue in force the same as if said notice had not been given by the party of the second part. And it is further agreed that if the said Edison shall not return to the party of the second part Eight Thousand Dollars ($8000) as herein before provided for the said party of the second part shall still have the right to terminate this agreement[16] It is further agreed that they the said parties of the second part will use reasonable diligence in prosecuting and establishing a permanent business for the sale of such apparatus in the United States as herein provided. It is further agreed that if the said parties of the second part fail to render a true and correct monthly statement of all sales for each and every month during the continuance of this contract as herein provided after the manufacture and sale of the article has commenced or fails to pay the royalty of twenty per cent on the selling price of all articles or apparatus containing the invention of the said Edison as aforesaid at the periods herein mentioned or do not use reasonable diligence in establishing and prosecuting the business of making and selling such apparatus within the United States then the said Edison shall have the right to terminate this agreement and it shall be null and void and all rights and licenses, and the said parties of the second part shall have no claims upon the said Edison for any money that may have been paid to him. It is further agreed, that if at the expiration of one year from the date hereof the said parties of the second part shall have failed to furnish Fifty Thousand Dollars ($50 000) for the purpose aforesaid, then the said Edison shall have the right to terminate this agreement but shall have no further claim upon the said parties of the second part[17]

It is further agreed that the said Edison will at his own expense protect as far as lays within his power the said invention from piracy or infringement and all improvements upon apparatus for the recording and reproducing of the human voice or other sounds except when such improvements relate to and are for specific use in telegraphy and solely adapted thereto and Clocks Watches and Toys aforesaid which may be made by the said Edison within seventeen years from the date hereof are to come within the provisions of this contract and the said Edison is to receive the percentage before mentioned upon all articles containing said improvements. To enable the said Edison to receive a just and equitable consideration through the medium of the twenty per cent royalty to be paid him, It is hereby expressly agreed that the minimum selling price for each and every apparatus for the recording and reproduction of the Human voice or musical sounds shall not be less than Eighty Dollars, but if at any future time it can be shown to the satisfaction of the said Edison that it would be advantageous to both parties to this contract to sell at a lesser sum or should any other person at any future time device[18] an[d] apparatus for a similar purpose not an infringement of the invention of the said Edison and render it necessary by its competition in the Market to sell at at a lesser sum then the said Edison shall name a lesser sum to enable the said parties of the second part to compete with the said other apparatus with profit but no discrimination in the matter of price shall be made between any corporation or individual where such corporation desire to buy and use in their business and not for resale to others

In witness whereof[e] we have hereunto set our hands and seals, this Thirtieth day of January 1878

Gardiner G. Hubbard — Hilbourne L Rosevelt
Geo L Bradley — Chas A Cheever
U H Painter — Thos A. Edison

Witness W K Applebaugh[19] for H.L.R. C.A.C. G.G.H & TAE
Witness R W. Devonshire[20]

ADDENDUM[f]

Menlo Park N.J. February 20 1878.[21]

In consideration of services performed and to be performed by Chas Batchelor of Menlo Park N.J. in perfecting the Phonographic apparatus above mentioned, I hereby agree to pay to the said Batchelor his heirs or legal representatives ten 10[g] per cent, of all monies which I may receive from royalties from the sale of machines under the above contract. It being understood that under the above recited contract, the said Edison receives but fifteen per cent of the twenty per cent therein mentioned, he the said Edison being under contract to pay U H Painter of Washington D.C. five per cent of the said twenty per cent for services performed in obtaining such contract. It is understood that the said Batchelor is not to receive any part of the ten thousand dollars paid to the said Edison to aid him in experimenting= This contract shall be binding upon the heirs or legal representatives of the said Edison

Thos. A. Edison

Witness Wm Carman[22h]

D (copy), NjWOE, Batchelor, Unbound Documents 1878 (*TAEM* 92:260). Another copy of this agreement is in DF (*TAEM* 19:16) and a printed version is in DF (*TAEM* 51:762). [a]Date from text, form altered; "Copy" in top left corner. [b]"by and" interlined above. [c]Interlined above. [d]"d" was erased. [e]Obscured erased word. [f]Addendum is ADS. [g]Circled. [h]Signature enclosed in left brace.

1. Although dated 30 January, this contract was not completed until the beginning of February. Doc. 1191; Hubbard to Painter, 31 Jan. 1878, UHP; a draft is in DF (*TAEM* 19:2).

2. George Bradley, a metallurgist and financier, was then organizing the New England Telephone Co. to market the Bell telephone in those states. *NCAB* 14:440; Tosiello 1979, 194–206.

3. Hilborne Roosevelt (1849–1886) was a first cousin of Theodore Roosevelt and a pioneer in the development of the electric organ. He had several electrical patents to his credit, including electrical devices for organs and telephone improvements. Along with Charles Cheever he organized the Telephone Company of New York. *DAB,* s.v. "Roosevelt, Hilborne"; Tosiello 1979, 215–16.

Roosevelt had first met Edison on 22 December. On 22 January he sent Edison an organ for use in his phonograph experiments, and three days later Edison recorded a notebook entry related to it:

> I notice in organ pipes that the slot through which the wind passes is provided with teeth I propose to try this on the edges of the hole in the Telephone= Mr Roosevelt says it makes the tone purer gets rid of the hissing sounds= This may be good for phonograph also= [Vol. 14:22, Lab. (*TAEM* 4:169)]

Cat. 1233:22, 356, Batchelor (*TAEM* 90:64, 231); "That Wonderful Edison," *New York World,* 29 Mar. 1878, Cat. 1240, item 463, Batchelor (*TAEM* 94:147).

4. This is "West Chester, State of Pennsylvania" in the printed version. DF (*TAEM* 51:762).

5. Edison's phonograph patent (U.S. Pat. 200,521) contained no explicit reference to any method that would remove material from the recording medium. His failure to include this point became the basis for an important legal contest. See *American Graphophone v. U. S. Phonograph Co.,* (*TAEM* 116:316).

6. This is "production" in the printed version. DF (*TAEM* 51:762).

7. U.S. Pat. 200,521 issued on 19 February.

8. Regarding Edison's contracts for the use of phonographs with clocks and toys see Doc. 1168 n. 7.

9. Daniel McLean Somers (1841–1912) was a former Park Commissioner of Brooklyn and a director of the Brooklyn Public Library. He was a member of the firm of Somers Brothers, tin manufacturers with a large factory in Brooklyn. The plant was absorbed by Steel Trust in which Mr. Somers was a large shareholder. Obituary, *New York Times,* 30 Aug. 1912, p. 9.

10. Henry J. Davies, a New York clockmaker who had been one of the incorporators of the Ansonia Clock Co. on 21 December 1877 in New York City, was general superintendent of the company in 1878. Letterhead of Ansonia Clock Co., 5 Feb. 1878, DF (*TAEM* 18:913); Bailey n.d., 13.

11. Nothing is known of Russell apart from his contract with Edison.

12. This is "accept" in the printed version. DF (*TAEM* 51:259).

13. This is "well" in the printed version. DF (*TAEM* 51:259).

14. This meant the selling price of the phonograph only and did not include supplies such as foil, recording points, etc.

15. This is "however" in the printed version. DF (*TAEM* 51:259).

16. This sentence is one of two clauses that George Bradley wanted added to the contract. Doc. 1191; Bradley to Hubbard, 25 Jan. 1878, Box 1205, NjWAT.

17. This sentence is one of two clauses that George Bradley wanted added to the contract. Doc. 1191; Bradley to Hubbard, 25 Jan. 1878, Box 1205, NjWAT.

18. This is "devise" in the draft. DF (*TAEM* 19:11).

19. William K. Applebaugh had been an assistant superintendent of Gold and Stock Telegraph Co., in charge of private lines and the bank department, and later took an active interest in the Manhattan Quotation Telegraph Co. and the Domestic Telegraph Co. At this time he was apparently connected with the Telephone Company of New York. Applebaugh was one of the incorporators of the Edison Speaking Phonograph Co. and was placed in charge of demonstrating machines at its offices in March. "Private Telegraphy," *Telegr.* 9 (1873): 19; Reid 1879, 622, 633; "The Phonograph," *Sci. Am.* 38 (1878): 193; Articles of Incorporation, DF (*TAEM* 51:771).

20. Devonshire worked in the offices of the Bell Telephone Co. in Boston. Thomas Watson to Hubbard, 3 Sept. 1877, General Manager's Letterbook; Watson to Hubbard, 12 Apr. 1878, Box 1205; both NjWAT.

21. On the same day, a similar addendum was added to another copy of this contract providing James Adams with five percent of Edison's royalties. DF (*TAEM* 19:24).

22. William Carman began working in the Menlo Park laboratory office as a bookkeeper and sometime secretary in early February. See *TAEB* 3:6 n. 5; Cat. 1185, Accts. (*TAEM* 22:549).

-1191-

To Uriah Painter

[Menlo Park,] Jany 31/78=

U.H.P.

Just returned from Ansonia went out to see Ansonia Clock Co works=[1] Big Concern= Davies is Supt= man who has clock contract= Have finished drawings of Dictating phonograph[2] & shall be greatly assisted by the clock people= who are very liberal= give me anything I ask for without charge= Phelps Dodge & Co are the main owners=[3] Bradley stuck on contract, one or two clauses didnt suit expect its over at office now, am going over tomorrow=[4] Asked J.C.R about selling Auto—said 100,000. I said wouldnt you take 70,000 he said he might thats all I could do with him= Those Patent office men owe me that Phono patent they are issuing patents that were filed long after some of my Cases=[5] Yours

Edison

ALS, PHi, UHP.

1. Ansonia Clock Co., founded in 1850, had offices at Nos. 19 & 21 Cliff St. in New York. It was a branch of Ansonia Brass Co. (est. 1844) and had begun making clocks in 1849. In December 1877 Ansonia Clock was incorporated as a separate company. The company continued to manufacture clocks in Ansonia but also had a factory in Brooklyn. Dreppard 1958, Supp. 3; Bailey n.d., 13.

2. Edison planned on using his disk phonograph for dictating letters (see Docs. 1174 and 1227, figs. 16–21).

3. Phelps, Dodge & Co. began in 1833 as a metal business partnership between William Earl Dodge, his father-in-law Anson Greene Phelps, and Daniel James, who conducted a branch of the business in Liverpool, England. The Ansonia Brass & Copper Co. and the Ansonia Clock Co. were subsidiaries. Dodge, who served as president of these companies, was also on the board of directors of Western Union. *NCAB* 3:174; Bailey n.d., 13; Wilson 1879, 272.

4. The clauses in question were included in the signed contract (Doc. 1190 nn. 16 and 17). George Bradley had indicated in a 25 January letter to Gardiner Hubbard that he wished these two clauses added and on 27 January Charles Cheever wrote Hubbard that Hilborne Roosevelt had shown Bradley's letter to Edison who "said he had just as [lief?] have those clauses [p]ut in." Cheever also suggested that Bradley "come on to New York and settle the thing" (Box 1205, NjWAT).

5. Edison had submitted twenty-five patent applications since 31 August 1876. Only one of them had issued at the time he wrote this letter. See *TAEB* 3, App. 3.

-1192-

From George Bliss

Chicago. Feb. 4, 1878[a]

Dear Sir:

Your esteemed favor of Jan. 31st is at hand.[1]

I do hope that you will not neglect that rotary press.

There is the most urgent need for it in the business and the call is so loud that half a dozen men are at work to get out an article.[2]

I should feel it very much if you allowed any one to get the start for it is simply a question of putting your attention in that direction to scoop them all high and dry.

I shall feel uneasy until you write me that the press is doing perfect work.

I am heartily glad that you have made the strike with the Painter crowd on the phonograph and only regret they got the start of me by having the resources at command which could not have been done had the instrument been sent here for me to work with.

If you send me out a phonograph I will get some notices in the leading western papers more favorable to your inventions than any which have heretofore appeared in this section.

You ought to do this on general principles for it will all help in future matters and do the phonograph people good.

Of course I want you to get me as much of a slice as possible in the phonograph but if it is small I cant complain of what is purely a gift.

If I did not know you had many good things in store I should go into permanent mourning on account of the turn affairs have taken in the phonograph matter.

I hope you will not do anything to prejudice your interests with the Western Union people for pleasant relations there ought to be your cardinal principle.

Now about the the pen business I dont want you to forget that when I took it money was being spent instead of having revenue coming in.

If matters have not gone altogether satisfactory you have still received a considerable[b] sum of money and more has been earned which will shortly be paid.

The future prospects are excellent and the revenue which will be enjoyed would satisfy an ordinary man but you are not of that kind.

I have spent $10,000.00 besides all the profits in the last year in advertising the business and in European expenses and have just made a single advertiseing contract amounting to over $1,300.00.

Fortunately I have now reached a point where the business will begin to yield net results and from this time finances will gradually ease up all round in this venture.

My company is certain to go through and I shall soon have an abundance of funds to organize the business on a scale it deserves and which it's best interests[c] .demand.

Don't forget that I assumed a guarantee against the advice of my business associates and took the European venture when the old heads rejected the project.

I have pioneered the royalty plan for you and have demonstrated that it is the best way to put your inventions adapted for the general public on the market.

This secures for you a revenue after the invention is made without farther bother and with very little annoyance of any kind.

More than this I have removed the bugbear of fear about trying to introduce goods abroad so that the world is opened up as a market hereafter.

What is better than all I am going to make a permanent success of the pen which will be the best basis of inducement for[b] parties disposed to take hold of your future inventions.

I believe the policy of scattering your inventions into the hands of a number of good parties is the best method to work but at the same time I am going to have a system of agencies at work which cannot be ignored in negotiations for the future good things which you produce.

I had your statement to Jan. 1st made out and it has been sent to you.[3]

Please advise if not received.

You will get some money shortly. Respectfully,

Geo. H. Bliss Gen'l Man.

TLS, NjWOE, DF (*TAEM* 15:221). Typed in upper case. Letterhead of Electric Pen and Duplicating Press, George Bliss, General Manager; letterhead and dateline are electric pen copy. [a]"Chicago" and "187" preprinted. [b]Mistyped. [c]Final "s" is added by hand.

1. Not found.

2. Bliss had already warned Edison about Engelmann's steam press (Doc. 1189). He subsequently wrote Edison about rotary presses being developed by Charles Puckette, who had a "fast press" that was "complete and works well" and could reputedly produce 600 impressions an hour, and by the Griest Manufacturing Co. which was planning to bring out a press that "those who have seen it say . . . is to be very fast." The only evidence of rotary press work at the laboratory are drawings by Charles Batchelor of 28 February and 3 May, a mid-May reference to work on the press in Batchelor's memo book, and an account book with several entries for May. This limited effort was explained by Batchelor in his 16 April letter to Bliss: "I think it is impossible at present to do anything on Rotary press we have got too many things of so much more importance on hand." Edison apparently turned the development of the press over to Bliss, who was still attempting to perfect it in mid-August. Bliss to TAE, 28 Jan., 12 Mar., and 15 Apr. 1878, all DF (*TAEM* 18:261, 278, 283); Batchelor to Bliss, 16 Apr. 1878, Cat. 1238:263, Batchelor (*TAEM* 93:189); TAE to George Beetle, 10 Aug. 1878, Lbk. 3:335 (*TAEM* 28:776); NS-78-001, Lab. (*TAEM* 7:716; 162:554); Cat. 1308:71, Batchelor (*TAEM* 90:702); Cat. 1185:182, Scraps. (*TAEM* 22:638).

3. Not found.

-1193-

From Edward Johnson

Jamestown N.Y. 2/4/78.

My Dr Edison

I send you today papers bills etc that I had been preserving to hand you on my return;[1] but as I am Compelled to repeat here and give one at Meadville Pa on Wednesday I shall not reach NYork until Friday morning, when I hope to see you. Having to take a man with me has increased my expenses so that I am not Netting as much as I had hoped to do. still I am doing ~~f~~very fair and have created such a stir that I could keep going straight along. But I want to return to NYork get a better Phonograph— increase my terms to cover expense of an assistant— Get one of your speakers[2] and start right. I then want no better business. I have been compelled to use a speaker to conduct my entertainments owing to impracticability of getting Telegraph Operators everywhere—when I had used it once then I had to do it all the time. But just as I imagined it attracts but little attention compared to the singer[3] You will notice this in the newspaper reports. I explain both Telephones & then tell the audience the practical difference, and as I have been working circuits averaging about 15 miles I have been compelled to yell pretty loud. The fact pointing my subsequent explanation of your Instrument very nicely when I tell them that in yours it would be only neccessary to whisper. I have been pressed to say privately[a] which is the most practical Instrument and of course I tell them yours, and why. And now a strong demand has been made on me to exhibit yours & In order to meet this I have teleghd Orton (to save money) to have you send me a set here. I want to use them between here & ~~Jamestow~~ Meadville Pa 70 miles good wire & If I could get them & do so I would see that the fact was heralded abroad everywhere as I have tried Bells & can only work them by yelling frightfully and repeating frequently. It is just the limit of Bells & I am well satisfied yours would work beautifully. And as my showing Bells has removed from me the flavor of a mere advertising exhibitor My substitution of yours, & its victory over the other would fit in well with what I have said in Lectures ever since last summer— I therefore trust you have sent it & It will reach me today

Don't let my showing Bells affect you. I will take care that their respective merits are just as apparent as when I simply talked of them

I hope the Phonograph progresses to your entire satisfaction My Exhibitions are growing in interest as I learn more & more of that Wonderful Instrument. The old thing has held on well & instead of playing out, Improves on use Yours As Ever

Johnson (Prof)

Thats a good little special to the Buffalo Express![4b]

ALS, NjWOE, DF (*TAEM* 15:217). [a]Obscured overwritten letters. [b]Sentence enclosed by right parenthesis.

1. For copies of the newspaper clippings reporting these concerts see Cat. 1031:2, 20–23, Scraps. (*TAEM* 27:733, 742–44). For the itinerary of Johnson's phonograph exhibition tour see Doc. 1184.
2. That is, one of Edison's carbon telephone transmitters.
3. That is, Edison's electromotograph telephone receivers.
4. This may be a brief undated article describing Edison's habits from his days as a telegraph operator in Memphis, Tenn., and the idiosyncracies of his handwriting. Cat. 1029:56, Scraps. (*TAEM* 25:190).

-1194-

Memorandum: Telephone Test

Menlo Park NJ.[a] Feb 4 1878

Speaking telegraph test Menlo Park NJ. to Philadelphia[1]

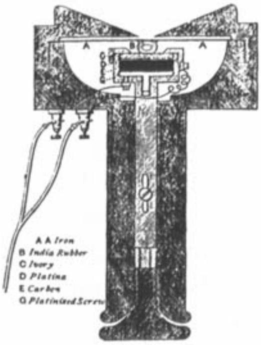
Bently[2] says

I am very much disturbed[b]

I am very much astounded and so must any one be who reflects a minute. I recognized your voice instantly[b]

Bentley got all we said and repeated it back Morse[c]

This opportunity to this afternoon and shall be glad to test them with you any time



A drawing of Edison's telephone transmitter from Scribner's Monthly.

AD, NjWOE, Lab., Vol. 14:37 (*TAEM* 4:178). Written by Charles Batchelor. [a]Place from text. [b]Followed by blank space sufficient for several lines. [c]Followed by horizontal line across page.

1. In his diary entry for this day, Charles Batchelor wrote "All day on Telephone tried experiment with Bentley of Philadelphia we talked to him and he got it all right we also talked to Washington" (Cat. 1233:35, Batchelor [*TAEM* 90:70]). For further information about these tests see Henry Bentley's 5 February letter to Edison enclosed with Doc. 1204. During his testimony in the Telephone Interferences, Bentley noted that, prior to 4 February, he and Philadelphia Local Telegraph Co. superintendent Samuel Plush had experimented with "the Edison carbon transmitter from one part to another of the building, at southeast corner Third and Chestnut street, and 107 South 3d street, an adjoining building." They conducted the 4 February tests to Menlo Park on Western Union's No. 7 wire (TI 1:318 [*TAEM* 11:136]).

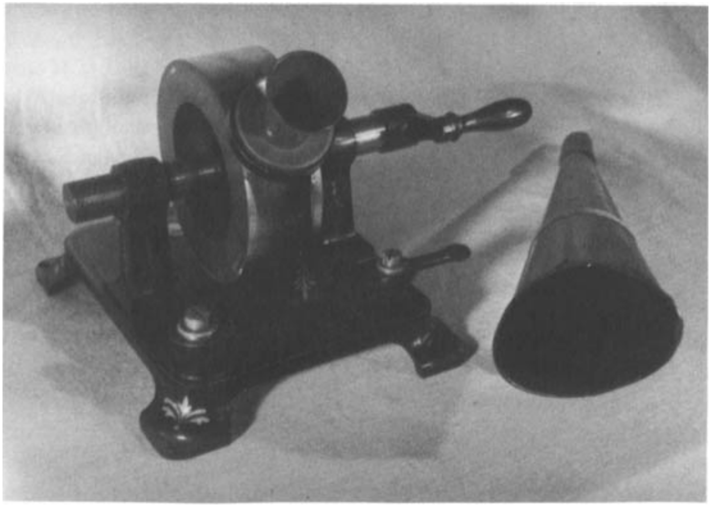
   The transmitters used in this test were like those made about 26 November (Doc. 1125). A drawing made 12 February by an artist from Scribner's shows the telephone transmitter being used at this time (see Doc. 1206 nn. 4 and 5; Prescott 1878a).
2. Henry Bentley was founder and president of the Philadelphia Local Telegraph Co (see *TAEB* 2:433 n. 4). William Orton had asked him to test Edison's telephone because of Edison's doubts about George Prescott (see Docs. 1173, 1204, and 1223; Bentley's testimony, TI 1:317 [*TAEM* 11:135]).

SMALL DEMONSTRATION PHONOGRAPH Doc. 1195

In early January, Edison had conceived a small, inexpensive phonograph that would illustrate the principle of recording sound. This machine, which would record only about fifty words, was intended to pique public interest without compromising the sales of the proposed commercial product.[1] Edison initially hoped that Theodore Puskas would be able to sell hundreds of such small phonographs during the impending Universal Exposition in Paris.[2]

Although Edison sketched the basic design for this phonograph in January, the earliest measured drawings for the machine date from 4 February.[3] By 6 February, Edison and Batchelor had devised a cylinder with a relatively massive rim that served as its own flywheel, which made it possible to maintain a fairly even rotation.[4] They began building two machines, the first of which they sent to Puskas on 24 February. The next month Puskas arranged for the Parisian manufacturer Edme Hardy to produce the instruments for sale at the Exposition.[5]

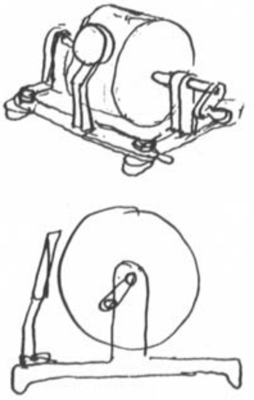
The threads on the shaft of this phonograph were cut sixteen to the inch to correspond to the grooves cut into the cylinder. The standard holding the diaphragm was "so arranged that it can be swung to or from [the cylinder] at pleasure, or the stylus adjusted to any required delicacy" by means of an adjustable stop.[6]



A small phonograph manufactured by Edme Hardy in Paris in 1878.

Edison built a few more of these machines at Menlo Park and loaned them to various friends and associates who exhibited them publicly and in their homes.[7] Shortly after beginning to build the prototypes, Edison had suggested to the Edison Speaking Phonograph Company that they sell such machines in North America, which they quickly agreed to do. Edward Johnson, the company's general agent, arranged for Sigmund Bergmann to make twenty-five.[8]

Batchelor suggested several changes to Johnson, in a letter of 11 March, all of which Bergmann made in the machines he manufactured.[9] To ease the adjustment of the swing-arm stop, Batchelor moved it to the front of the arm; he had Bergmann cast the diaphragm standard as a separate piece with adjusting screws that changed the depth to which the stylus fit into the cylinder grooves; and he made the arm thicker to provide a larger bearing surface for the pivot screw. Bergmann also used four screws instead of two to mount the mouthpiece to the standard.[10] However, the machines were not well made and failed commercially.[11]


Sketches from 8 January for the small demonstration phonograph.

1. Doc. 1198. In a 19 February 1878 letter to Frank Scott, Edison suggested the capacity would be about 60 words (private collection of Craig A. Fouts, Encinitas, Cal.).

2. Batchelor wrote in his diary entry for 6 February 1878: "Designed model phonograph for Puskas to sell at Paris exhibition." Cat. 1233:37, Batchelor (*TAEM* 90:71); see also Docs. 1196, 1198, and Puskas's telegram to Edison of 14 February ("Waiting for promised small Phonograph cable cost if thousand ordered"), DF (*TAEM* 97:622).

3. Vol. 17:32, 47–49, 58, Lab. (*TAEM* 4:916, 925; 97:613, 615). An undated technical note, labeled "Model," was incorrectly identified in Supp. I as 1877, but clearly dates from 1878 (*TAEM* 97:605).

4. Cat. 1233:37, Batchelor (*TAEM* 90:71); Vol. 17:50 (*TAEM* 4:917). In practice, however, it was found that "the small machine holds so little that it cannot be run long enough to get up an even speed" (Edward Johnson to Uriah Painter, 28 Mar. 1878, Box 1205, NjWAT.

5. TAE to Baldwin Bros. & Co., 24 Feb. 1878; TAE to Puskas, 27 Feb. 1878, both Lbk. 1:349, 369 (*TAEM* 28:221, 233); Docs. 1248 and 1259. One of Hardy's instruments, which were sold for 200 francs ($40), is now in the Musée National des Techniques, CNAM, Paris (Inv. 8920-0000); another is in the Deutsches Museum, Munich. Hardy fitted a small ebonite cone to the mouthpiece to aid in recording. Charbon 1981:51–53; Du Moncel 1974, 246–47; Puskas to A. L. Fleury, 17 July 1878, DF (*TAEM* 15:968).

6. Plush 1878, 270. The stop screw is visible behind the right end of the swing arm; see also the illustration of the Hardy instrument in Charbon 1981, 53.

7. Doc. 1195 represents a phonograph sent to Henry Bentley in early March ("The Speaking Phonograph," *New York Daily Graphic,* 12 Mar.

1878, Cat. 1031:82, Scraps. [*TAEM* 27:781]; Doc. 1247; Plush 1878). See also, e.g., Charles Batchelor to William Hollingshead, 25 Feb. 1878, Lbk. 1:352 (*TAEM* 28:223); "The Phonograph, A Machine that Talks and Sings," *Brooklyn Daily Eagle,* 26 Feb. 1878, and "The Phonograph," *New York Tribune,* 25 Mar. 1878, both Cat. 1240, items 385, 455, Batchelor (*TAEM* 94:117, 143); and Docs. 1263 and 1304.

8. Docs. 1198, 1238, and 1246.

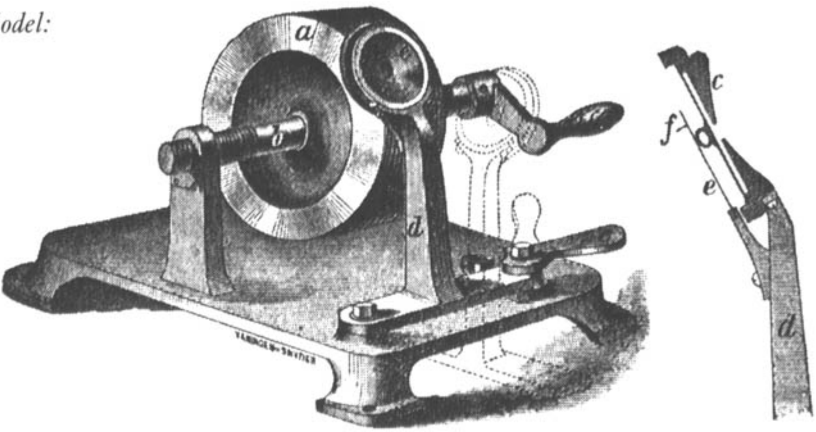
9. Lbk. 1:426 (*TAEM* 28:285).

10. The experimental machine that survives at the Edison National Historic Site (Cat. 311) has a different adjustment for the standard and incorporates a method of securing the tinfoil that was not developed until the end of June. See Doc. 1397 n. 3.

11. See Docs. 1302 n. 4 and 1276 n. 4. Du Moncel indicates that the version produced by Hardy in Paris may have been more successful (Du Moncel 1974, 246). The known surviving Bergmann phonographs of this type include two that were modified by Alexander Graham Bell, Chichester Bell, and Samuel Tainter during their phonograph experiments in the early 1880s. One of these is in the Smithsonian Institution (Cat. 312,123) and the other is owned by Charles Hummel.

-1195- [Menlo Park, c. February 6, 1878][2]

Experimental Model: Phonograph[1]



M (historic drawing) (28 cm × 19 cm × 21 cm), Plush 1878, 270.

1. See headnote above.

2. These illustrations appeared in the April 1878 issue of the *Journal of the Franklin Institute;* the drawings were made on 9 March (see Doc. 1247). This machine was not subjected to the various modifications subsequently developed at Menlo Park and by Edward Johnson and thus represents the initial design from early February, as do the models made in France somewhat later. The illustrations accompanied a report by Samuel Plush (filling in for Henry Bentley, who was ill) to the 20 March 1878 meeting of the Franklin Institute, dealing with Edison's latest telephone as well as the phonograph. The faint dotted lines represent the movement of the mouthpiece-supporting swing-arm (and

latch) away from the recording and reproducing position. The drawing of the mouthpiece c shows a small "delicate spring" e with a "sharp-pointed stylus" f on its end. The spring and stylus rest against a small piece of rubber tubing (the oval to the right of f) that was cemented onto the center of the diaphragm.

-1196-

To Theodore Puskas

Menlo Park NJ Feby 8—1878[a]

Friend Puskas

I send you a copy of my contract with the Cheever Hubbard people,[1] they have all signed and paid the money I write this very quickly and you may have some trouble in deciphering it—You can probably get it copied The model of the small phonograph is nearly finished It will go soon with more telephones—next lot of telephones will give you less trouble than the ones taken as I expect you have had trouble with the Bell Call.[2] The plate phonograph is goihg to be a big success—we have completed drawings and have started making one—[3] am receiving much assistance from the Clock people & have been up to Ansonia for 2 days they have ½ doz men experimenting on its application to clocks=[4] Received your telegram today=[5] I will tomorrow or sunday make out the papers to meet the conditions of the English case= This paper you can alter erase & change to suit them and if satisfactory to me can return and deposit with Brewer & Jansen=[6] I can send a supplementary agreement between us=[7] as the English case is peculiar how shall we devide— Yours

Edison

ALS, HuBPo, TP. [a]Place and date cut off on photocopy; taken from typed transcription in HuBPo.

[1] Doc. 1190.

[2] The circuit arrangement for the call bell in the telephone sets taken by Puskas in January is shown in Doc. 1182. For Edison's efforts to deal with the call bell problem see Doc. 1226.

[3] See sketch of 15 February and measured drawings of 16 and 20 February. Vol. 17:54–56, Lab. (*TAEM* 4:921–24).

[4] On 5 February, Henry Davies sent Edison a clock for a phonograph to be put in and told him that "We have been very busy experimenting at Ansonia and the latest advance made is to put the point directly on the diaphragm.—then by speaking lound you can indent the Brass roller itself— We hope in few days to be able to arrive at something defonate." DF (*TAEM* 18:913).

[5] That day Puskas cabled Edison "First class House agrees to advance 2000 pounds cash for English Phonograph and to give us half profits on whole sale and retail sales expenses all born by them reply immediately and press for 3000" (DF [*TAEM* 19:209]). Edison replied

as requested (see Doc. 1197). The "House" in question was the London Stereoscopic and Photographic Co., run by George Nottage; see Docs. 1237 and 1265. The exchange rate in this period was somewhat less than five U.S. dollars for one British pound sterling (*Ency. Brit.*, s.v. "Money").

6. Edward Brewer and Peter Jensen were London patent solicitors used by Lemuel Serrell in connection with Edison's British patent applications. E.g., Brit. Pats. 4,502 (1878) and 3,880 (1880); *TAEM-G1–2*, s.v. "Brewer & Jensen"

7. Puskas's agency under his 17 December 1877 agreements with Edison and George Bliss neither included nor excluded the United Kingdom. It covered seven European states and empires (Belgium, France, Spain, Italy, Austria-Hungary, Germany, and Russia), excluded the United States and Canada, and allowed extension to other countries in which Puskas would pay for patents. Kellow (*TAEM* 28:1195, 1204).

-1197-

Charles Batchelor Diary Entry

[Menlo Park,] Friday Feb 8 18778.

New York Called at Bergmans, Ecauberts,[1] Fitch & Meserole,[2] Thaus,[3] Patterson Brs—[4]

Made model drawing for Inst for show principle of Edison Speaking phonograph—[5a]

Edison got offer for speaking phonograph by Cable from Puskas £2000 & half profits he cabled back, would sell for £3000

AD, NjWOE, Batchelor, Cat. 1233:39 (*TAEM* 90:72). [a]Followed by centered horizontal line.

1. Frederick Ecaubert was a New York toolmaker located at 41 Green St. On 8 February he charged Edison $100 for a "Model of printing Press" that may have been a rotary press design for the electric pen. Folder 78-007, DF, NjWOE; Wilson 1878, 394.

2. Frederick Fitch and A. V. Meserole were partners in Fitch & Meserole, an electrical manufacturing firm located at 40 Courtland St. in New York City. According to their letterhead, they specialized in making the late Leverett Bradley's patented "Naked Wire Helices for Electro-Magnets." At this time they were making induction coils for Edison's telephone receivers, and on the same day Batchelor visited their shop they wrote Edison that "the balance of the Experimental coils will be finished today and left at 'Pen' office Church St." Doc. 1177 n. 3; Fitch & Meserole to TAE, 8 Feb. 1878, DF (*TAEM* 18:421).

3. Henry Thau had been one of Edison's machinists in Newark before opening his own shop in New York in 1872 (see *TAEB* 1:622 n. 14). He was listed as a telegraph instrument maker located at 85 Nassau St. in Wilson 1878 (p. 1394). At this time he was making telephone transmitters for Edison (see Doc. 1177 n. 2).

4. Patterson Bros. was a New York hardware dealer located at 27 Park Row. Patterson Bros. bill to TAE, 26 Feb. 1878, 78-007, DF, NjWOE; Wilson 1878, 1102.

[5] The instrument is Doc. 1195; three measured drawings from this date are in Vol. 17:47, 49, 58, Lab. (*TAEM* 4:916, 925).

-1198-

Charles Cheever to Gardiner Hubbard

New York, Feby 9th 1878[a]

Dear Mr Hubbard

Edison has appeared here today with his Phonograph, also Johnson. I find that Roosevelt had suggested your idea of putting the money in the Trust company and paying him in installments, but he did not like it, he said it was a reflection upon his ability to take care of himself that he proposed to buy United States bonds with the money and sell one at a time as he needed the money. I therefore concluded that it was best to pay him. I have today given check for $6,000, $2,000 paid him saturday last and $2,000 still due.[1] While he was here a friend of mine brought in the Tenor[2] of the opera company which is going to sing in the Academy next week, said Tenor interviewed the Phonograph which very much delighted himself and Edison as well. Edison suggests the following. That 500 small Phonographs be made similar to sketch enclosed,[3] with the cylinder only large enough to hold about 50 words. He says these machines to be sold at a low price, say $25 or $30 merely as specimens of the Phonograph for the use of scientific individuals of various sorts, says he has a large number of applications from professors of various colleges and other people who wish to buy them just as a novelty and he thinks pending the time when he will have the perfect machine completed a good deal of money could be made in selling these small traps as a novelty, explaining to the customer that it was merely as an example of what the machine would do and not a finished working machine which was sold them. I told him that I did not think it was best to do that until after the patent was issued at any rate. He agreed with me in that, but said he expected to see the patent issued in a very little while.[4] On first thought I think this would be a very good idea, it seems as if we might sell upwards of a thousand of them at net profit clear of the commissions &c of $15 to $20 each. Johnson says that he wishes to make an arrangement to have the use of a Phonograph for exhibition purposes at once, that he finds it attracts large numbers of people and will pay. I did not tell him what you said on the subject on Sunday last. I *did* say to him that I would write and consult with you on the subject. Please send me such a letter as I can show Johnson.[5] Upon consideration I do not fully agree with you as to the point of not showing the phonograph until we are ready to supply the demand. I think it would be better perhaps to let it be seen and talked about and get people anxious about it and at the same time by constantly showing and hearing the criticisms and suggestions thereon, we will get a great many ideas which we would not otherwise obtain. I think this point is also an argument in making the small show Phonographs spoken of as above by Edison.

Edison is making 2 of these small machines now, they will be done next week one of them is to be sent to Puskas and the other one Edison has promised to me. By the way Edison received a telegram yesterday from[b] Puskas saying that he had been offered for the English patent on the Phonograph £2,000 and half the profits of the business. Edison is pleased to death with the offer but replied to Puskas that he would do it for £3,000 and half the profits Yours truly

Chas A Cheever

P.S. Nothing heard yet from the Western Union[6] Orton will be back in about a week[c]

LS, NjWAT, Box 1205. Letterhead of the Telephone Co. of New York. [a]"New York" and "187" preprinted. [b]Repeated at end of one page and beginning of next. [c]"Orton . . . week" in Cheever's hand.

1. This refers to the $10,000 due Edison under terms of the 30 January agreement for his phonograph (Doc. 1190).

2. Operatic tenor Charles Adams made his New York debut at the Academy of Music on 11 February 1878 with the Pappenheim-Adams Opera Company, singing a lead role in Giacomo Meyerbeer's *Les Huguenots.* A native of Massachussetts, Adams had only recently returned to the United States after eighteen years abroad, during which he had a long tenure as the Vienna Imperial Opera's principal tenor. "'The Huguenots'—Debut of Charles R. Adams," *New York Daily Graphic,* 12 Feb. 1878, 686; *NGD,* s.v. "Adams, Charles R."

3. Not found; see Doc. 1195.

4. U.S. Patent 200,521 issued on 19 February.

5. Not found.

6. On 4 February, Cheever had submitted a proposal to William Orton and Norvin Green on behalf of the Bell Telephone interests regarding a merger of the telephone business. On 9 February, Orton had not yet returned from a trip west and Green wrote Cheever rejecting the proposal but suggesting that they hold further meetings. Tosiello 1979, 239–43.

-1199-

To Clarence Blake[1]

Menlo Park N.J. Feby [9, 1878?][2]

Dear Sir.

I have made 9 phonographs to date and the savans have taken them all.[3] Prof Mayer and Schellen[4] the last two. I am making a smodel of a smaller size that can be made very cheaply. These machines only illustrate the principle. The articulation is no better than the ordinary run of telephones, owing to the impossibility of rotating the cylinder evenly by hand. I am however making a complete machine for introduction to the public, with a clock work motor this apparatus will articulate I think better than a telephone. the volume of sound is about ½ that of the original. These machines will be out in about 2 months. The small hand ones will be out in two weeks. You can obtain these from Chas A Cheever, Tribune building New York= I suppose you would need an extra lever for indenting the movements of the lips.[5] Prof Mayer has an apparatus whereby he measures the indentations to the ¹⁄₁₀,₀₀₀ of inch. he claims that it is an instrument of precision owing to the possibility of verifying the records. Yours Truly

T A Edison

ALS, MB, CJB.

1. Dr. Clarence Blake was an ear specialist and acoustic researcher in Boston who had worked with Alexander Graham Bell on phonautograph experiments. Doc. 1150; Bruce 1973, 112, 121, 128–29.

2. The content of this letter strongly suggests it was written soon after Edison's 9 February meeting with Charles Cheever (reported in Doc. 1198). Blake responded to it on 11 February (DF [*TAEM* 18:916]).

3. The same number appears in a notebook entry that Charles Batchelor probably wrote in late April (PN-78-02-24, Lab. [*TAEM* 44:4]). It is unclear whether this count encompassed only flywheel phonographs like those sent to Mayer and Schellen or also included any earlier machines without flywheel (see headnote p. 10). Among the nine phonographs are one or both of those Theodore Puskas took to Europe in January and one sent to William Preece (Docs. 1182 and 1204). Another may have been the one Edward Johnson was using for exhibitions, and Edison retained at least one such machine for experimental use and demonstrations at Menlo Park.

4. On 24 December, Henry Morton had sent Edison a letter from Heinrich Schellen, director of the Realschule in Cologne, Germany, and author of a standard reference on telegraphy, requesting one of Edison's telephones (Doc. 1156). There is no correspondence regarding the phonograph Edison sent him.

5. See drawing of 8 February, NS-78-007 (*TAEM* 7:870).

-1200-

To Theodore Puskas

Menlo Park NJ Feby 10= 78

Friend Puskas

I have shipped Mr Preece his phonograph= If you are in London in 15 or 20 days you might call on him and shew him how to work it= I have sent him full instructions= Please ascertain if he is favorable to me in Telephone matters as I have heard some reports to the Contrary=[1] It has been suggested that profit basis would be bad as one could never know how much was made so I telegraphed you to close the bargain on royalty basis of either 15 or 20 per cent on the selling price the same as they pay here[2] I suppose everything is included in English offer ie[a] clocks watches toys and dictating machines= I am writing a contract tonight to cover the English which you might submit to them[3]

The new ~~w~~clockwork machine is going to be a big success; There is a great deal more excitement here now over phono than when you left. James thinks he ought to be paid something—

I suppose that you might be able to do something on ~~P~~ Telephone in England if Preece is going to do nothing I am going to send him a pair of[b] machines soon and I shall watch and see what he does: =[4] Yours

Edison

I am worried a little over your Telephones as we have discovered bad workmanship in others made by Bergman & Co—[5] You will get some more soon

Worked[c] from Menlo to Phila the other day with perfect ease 24 wires on pole— I sent the report to press[6] from Bently at Phila= Whispering came well

ALS, HuBPo, TP. [a]Circled. [b]"pair of" interlined above. [c]Paragraphs of postscript separated by wavy, vertical line.

1. No such reports have been found.

2. Edison's cable has not been found; apparently this was separate from the cable mentioned in Doc. 1197. Under the terms of his American phonograph agreement, Edison was to receive twenty percent on the actual selling price of the instruments but an addendum of 20 February gave five percent to Uriah Painter for his services in obtaining the agreement (Doc. 1190).

3. According to Doc. 1207, this and the two following letters (Docs. 1201 and 1202) were sent together with the draft agreement on 11 February.

4. See Docs. 1212 and 1348 regarding Edison's belief that he had an arrangment with Preece regarding the promotion of his telephone and phonograph inventions in the United Kingdom.

5. See Doc. 1177.
6. Edison apparently meant "Preece"; see Doc 1204.

-1201-

To Theodore Puskas

Menlo Park Feby 10/78

Friend Puskas

This is a rough copy of what I think[1] could be fixed up by scratching[2] you might get it copied in plain hand= I have no copy of it as I send it o~~ut~~ff tomorrow & have no time to make a copy ~~y~~ It is on the basis of my US Contract but not so harsh please explain to your people about the patent covering telephone & Phonograph so there will be no misunderstanding[3] notice clause about returning ½ of money. ~~if~~ of course theres no chance of failure but ~~It~~ I think it but right to put it ~~it~~ in I did it of my own accord in the US Contract[a] they[a] did not ask it.[4] Yours

Edison

ALS, HuBPo, TP. [a]Obscured overwritten letters.

1. Not found; for the settled terms see Doc. 1237 n. 1.
2. That is, Puskas could "alter erase and change" it (see Doc. 1196).
3. Edison's British Patent 2,909 (1877) was primarily a telephone patent (Doc. 973). The preliminary specification had included the phonograph as a telephone recorder; in the final specification, the phonograph was made an invention in its own right. This soon caused significant concern regarding the legal strength and commercial worth of the patent (see Doc. 1237).
4. Edison's American phonograph contract (Doc. 1190) actually stipulated that in the event of his failure to produce a satisfactory product in a year he could be called upon to return eighty percent of the initial $10,000 payment.

-1202-

To Theodore Puskas

Menlo Park [February] 10= 1878

Friend Puskas

I see by the Scientific papers that Breguét[1] a celebrated instrument maker of Paris has just discovered my carbon telephone he read a paper Jany 9 before the Academy[2] describing the use of carbon in a telephone says great results is to be expected from it= The ~~f~~French must be a very isolated people as Preece mentioned the fact before the British Association Oct 11 1877,[3] that I had discovered that carbon varied its conductivity by pressure and had ~~i~~ employed it in a telephone= Besides there is their own French patent=[4] you might look into the matter when you are in Paris, and notify Breguét of existence of French patent Yours

Edison

P.S. Obtain a copy of French ~~a~~English & other patents from Brewer & Jensen for your information.

ALS, HuBPo, TP.

1. Louis Breguet was a noted maker of scientific instruments and watches whose firm became the dominant French electrical manufacturer with the introduction of the telegraph in 1844. Although Breguet lost his monopoly on instruments manufactured for the French telegraph service in 1853, he remained a major figure in the industry. Butrica 1986, 158–72.

2. The 17 January issue of *Nature* (17:336) had published an account of the 7 January meeting of the Paris Academy of Sciences at which Breguet had read a paper entitled "On some new modifications in the telephone" in which he discussed the use (by others) of a blacklead pencil to vary resistance in a telephone transmitter. A paragraph in the *English Mechanic* of 25 January also reported use of "the variable galvanic resistance of graphite" in telephones by MM. Garnier and Pollard of Cherbourg, mentioning Breguet merely as one who thought this "promising," and Batchelor wrote under it in his scrapbook: "This is the principle of our telephone which we have worked since last March" (Cat. 1240, item 350, Batchelor [*TAEM* 94:105]). In mid-April, Batchelor and George Barker "tried the lead pencil experiment of those two Frenchmen about putting it against the diaphragm but could only get sounds no articulation" (Batchelor memorandum, c. 12 Apr. 1878, DF [*TAEM* 15:517]).

3. Actually in August 1877; see *TAEB* 3:640 n. 9.

4. Edison's French Patent 121,687, filed and dated 19 December 1877, was not officially granted until 19 February 1878. It had evidently been approved by the end of January, however, as George Bliss wrote to Edison on 12 February that he had received a letter from France containing that news. DF (*TAEM* 18:628).

-1203-

To Alfred Mayer

Menlo Park Feby 11/78

Friend Mayer

Briefly I have found following points[1]

1st that Sheet copper same thickness of the tin foil will be indented and record, that the indentations are slight compared with the foil but that the reproduction is nearly as loud and in one instance louder than the voice of the original speaker; defects are rough surface of copper gives extra sounds and wears[a] indenting point. The point when copper is to be indented is secured directly to diaphragm hence no loss motion as with the rubber tube and consequently great volume of sound from light indentations. This proves that the foil should[a] have some antimony in it to harden it so that the employment of the rubber tube can be dispensed with or at least a stiffer one used[2]

2nd That the smaller the diaphragm the better the articulation; but a large diaphragm may give clear articulation if it is dampened on both sides. The reason why dampening of the diaphragm gives better articulation is that when the diaphragm is free its impact against the foil gives rebounds too small to be seen but enough to give harmonics and because it brings the diaphragm to its normal position quicker after each vibration than it would if not dampened.

3rd That the smaller the chamber in the speaking tube the sharper the articulation, if the chamber be increased the articulation is muffled (I mean when the speaking & reproduction takes place with chamber)

4th. That the size of the hole through which[b] you speak has a great deal ~~d~~to do with the articulation. when words are spoken against the whole diaphragm the hissing sounds as in shall fleece last are lost whereas by the use of a small hole provided with sharp edges these sounds are reinforced and are recorded The hissing sounds give wind rushes which pass out of the mouth ~~at is~~ downward = That teeth around the edge of a slot instead of a round hole gives the hissing consonants clearer:[3]

5 That an extra lever placed in the mouth piece connected to the diaphragm may record the lip movements and in reproduction the same lever may possibly[b] be used to open and close the aperture to the diaphragm (the lever I have tried, the last not)

6 That the best reading is obtained when the mouthpiece is covered with several thickness of cloth so that the scraping noise on the foil is rendered less audible.[4]

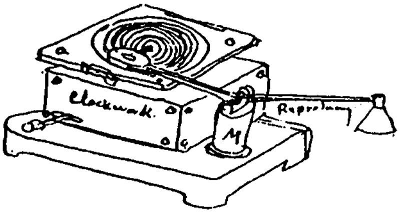
7th That with the hand machine,[5] (well adjusted)—a sentence of 100 words may be read in the presence of a person and he will generally read every word in one case 8 hours after hearing it read, but that a person who has not heard it ~~it~~ cannot ~~be~~ read until it has been reproduced several times. (this is like shorthand reporters their notes are only aids to memory because generally one shorthand reporter cannot read the others notes. Yet if both were present and the subject had 10 000 words both would read the notes readily even days after =

8 Another phenomenon I have noticed is that If ~~a p~~ two simple but[c] different sentences are put on the machine, and a person who had never heard of such an apparatus be brought in and told to listen he will not even after a dozen repetitions be able to say what it is, but if the first sentence is told him & then reproduced he generally says why thats perfect the second sentence is now reproduced when he generally reads it or part of it the first time and the whole the second time if simple= The same thing has been noticed in the telephone, and I think it lack of confidence, or some obscure effect of the mind upon the hearing apparatus. They do not expect or imagine ~~a~~that a machine can talk hence cannot understand it words

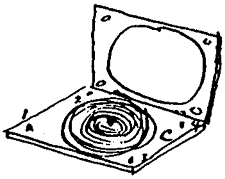
9th That it does not appear to make much difference in the articulation what shape the indenting point is made

10th That the scraping noise is less on composition foil than with pure tin foil although the latter appears to have a smoother surface

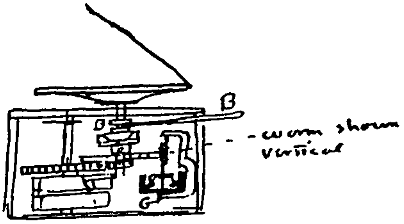
There are many other small things, but the above is what may be called results of experiments in the last few days= Below is rough sketch of the new machine we are making[6] Will keep you posted on any new results, and send you sheet of copper upon which I made records in Ansonia, that could be ~~heard~~ Read[b] 275 feet in open air, and perhaps further if it had been tried.[7]



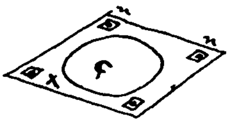
M Swivel lever & post[8]



C the revolving plate with volute spiral the inner half to guide arm outward the outer half to indent upon 1, 2, 3, &, 4 pins to pass in eyelets, holes in frame fit over them; eyeleting done in a guage.



Vulcanite wheel in worm to lessen noise.[9] winds by lever like music box B.B. friction clutch for stopping & starting plate instantly allowing clockwork to go on G a friction-pendulus governor



prepared sheet X is paper f is foil stretched over it. n n eyelets for registration. Yours Truly

T A Edison

ALS, NjP, Hyatt & Mayer. [a]Obscured overwritten letters. [b]Interlined above. [c]"simple but" interlined above.

1. On 9 February, Mayer had written Edison about his experiments with the phonograph he had just received and indicated that he would "have an illustrated article on it, out in about 2 weeks, and I naturally wish all I can get from you to make the information it contains up to date Could you not favor me with a concise account of what you have done since I last saw you, & put it in such form that it could be published in my article? (DF [*TAEM* 97:620])." In his 14 February reply to this letter, Mayer stated that he would "embody results in the article; which I think you will like. It will be illustrated with about 15 cuts. It is, of course, of a popular character," and in a letter dated 6 March he told Edison the article was for *Popular Science Monthly* (DF [*TAEM* 18:918, 935]). The "popular character" of the journal in that era meant only that articles were not written for specialists and avoided most mathematics, but articles frequently provided lengthy and intricate discussions of difficult subjects by highly respected authors. Mayer eventually prepared eighteen illustrations but then had to severely reduce the article's length and eliminate all but three of the figures (Mayer 1878a; Mayer to TAE, 7 Mar. 1878, DF [*TAEM* 18:939]).

2. Cf. Doc. 1188.

3. Mayer quoted this paragraph in his *Popular Science Monthly* article (Mayer 1878a, 724). This result drew upon Edison's prolonged work on related problems with telephones.

4. Mayer quoted this paragraph in his article (Mayer 1878a, 724).

5. That is, a hand-powered phonograph. Edison had already experimented with a weight-drive clockwork powering a cylinder phonograph

(see Doc. 1204) and was working on at least one other clockwork design—the plate phonograph described below.

6. Calculations for the gear ratios and drawings of the new plate phonograph from mid-February are in Vol. 17:51–57, Lab. (*TAEM* 4: 918–24).

7. See Doc. 1188. Mayer quoted from this sentence in his article (Mayer 1878a, 724).

8. The funnel at the end of the "Reproducing" arm pivots on "M" to rest on the diaphragm and stylus for playback. Text on base is "Clockwork."

9. Text is "worm shown vertical."

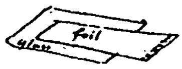
-1204-

To William Preece

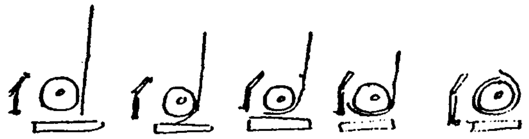
Menlo Park N.J. Feby ~~10~~11/78

Friend Preece:[1]

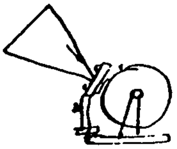
I suppose you think by this time that I promise many things and send none= However I have this day sent you by Austin Baldwin's Express[2] an experimental phonograph suitable for lecture purposes. I do not know how your people will take it but where it has been exhibited here before an audience, it created an immense excitement which I cannot account for= I will send you a supply of tin foil, you can probably obtain what you require there—get it smooth and free from wrinkles= to smooth it for putting on the machine lay on a pane of glass and rub with a strip of the tin foil itself—for putting it on the machine push the foil forward so about [an?][a] inch of the end comes off the glass and lays on the table. the brush a little thick shellac varnish on the edge say ¼ inch of edge thus— Then pass under cylinder and secure=



Be sure the lap is towards you as the machine turns from you—do not turn backwards when the diaphragm is set= Be sure and have the foil on tight there is a knack in putting it on thus which you will soon get



You will observe that the machine makes a continuous indentation this is to record the outward movement of the diaphragm and also ensure reproduction. You will also notice that the diaphragm is dampened by rubber tubes—this is to make clearer articulation by preventing the rebound of the diaphragm against the foil; be sure that the indenting point is central over the groove and so the continuous indentation is central you can ascertain its central position by passing the pointed end of the small adjusting pin sent you over the foil the indentation made by this point shows if the other indentation is central. The loudest talking is obtained when the lips just touch the edge of the hole in the mouth piece. You can easily test this by saying "how do you ~~th~~ get this" about ½ inch from hole again ¼ inch again ⅛ then 1⁄16 and then with lips lightly in Contact. Speak in a deep[b] bass voice if the audience is large, use a funnel of paper—thus



that is about ~~1 foot~~ 10 inches[c] at the mouth—and slightly largeer[d] than the hole in the mouthpiece at the bottom and about 1 foot long You might try several Sizes= The right speed I think is about 120 turns per minute. Music is best reproduced at high speed. It is impossible to turn the crank so even as to make any harmony in a song with notes long dwelt on like the Last[d] Rose of Summer etc but any thing very quick comes out fairly= I had one of these Machines run by a clockwork controlled by a pendulum[3] the Last Rose[d] of summer was reproduced beautifully [-][c] Whistling will come on your machine. in whistling put lips ½ inch from hole— After a while your point on diaphragm will wear I think though I have had none wear yet so you might observe its shape etc so that another one can be made= You notice I use strips narrower than the cylinder= I do this because they are more easily put on= In carrying the machine about ~~beca~~ be careful not to allow the fly wheel to hit anything as the shaft may be bent= Keep plenty of oil on the shaft as it soon drys and it becomes difficult to turn Steady= The practical machine for introduction to the public is most finished and it will be a great success ~~and~~— Have you ever done anything with the Motograph Telephone— I have made one for Prof Schellen also a phono who is going to lecture through Germany= The Motorphone or Electromotograph[f] that Johnson is exhibiting here is absolutely perfect all tones being pure and the Volume of Sound tremendous= About my speaking Telephone: I shall send you a complete set soon and I think they will be satisfactory on your wires. The reason of my delay lies in the fact that I must get something to work on wires that Bells will not and you know how difficult that is. I have been working my telephone from[d] Menlo Park to Washington and Philadelphia. T~~o~~he Quadruplex and Phelps Printers[4] bothered me to Washington (24 wires on the pole) but we carried on a long conversation ~~be~~to Phila 70 miles 3~~5~~4 wires part distance & 24 wires same pole the balance it was a perfectly practical circuit he getting my whispering I send you his letter.[5] You will probably remember him[6] he has charge of all the G & Stock City wires and private lines in Phila under WU auspices. A Comparative test made between mine Bells, (Phelps Bell) & (Grays Bell) Telephone[7] between Main[d] office in NYork and Mr Ortons house by Mr Orton him self on a regular city wire running on regular poles showed that mine was practical to whisper on while the others you had to shout and get scarcely anything at that I refer you to Mr Orton= Dont ask Prescott. He does not scruple to lie about me in the most outrageous manner, and is doing everything in his power to prevent my telephone from being used because I will not do[d] the same thing with him as on Quadruplex= They are telling all kinds of stories about you in relation to Quadruplex, what you said to Stearns[8] etc which I am sure are fabrications. I received a letter from the Polytechnic Institution[9] London for a phonograph ~~b~~for exhibition before that institution, but I was told by a gentleman from London[10] that it was a money making concern so I refused to send them one at present= If you do not care to bring it before the public, or have no time please let me know. Get a copy of my British Telephone patent[11] theres lots in it

I have made a new discovery[12] which I will write you again soon It is as curious as the Phonograph— Yours

T A Edison

P.S. Some 6 weeks after Herz's[b] leaving here I ascertained he was a huge humbug which was confirmed by his draft being returned protested never heard of such a man the bank said— E[13]

ENCLOSURE[g]

Philadelphia, 2d Mo. 5th 1878[h]

Friend Edison,

Yours relative to telephoning Wash'n rec'd.[14] No doubt the Quad batteries would bother you on that distance. I expected fully they would do it on your trial with me and I so stated to our sup't Plush[15] before you began. Because the wire you worked to us on went in and out of the W.U. Cupola at 10th & Chest in the same cable with the Quad wire and also into our Cupola in the same cable with our Quad. I hardly thought it would[b] stand that racket but it did to our great surprise—and could not have been better as I can see[16] We are soon to see great changes in the telephone I can easily see. Hurry mine up please and I will show them up

H Bentley

ENCLOSURE[i]

Phila Feby 10th 1878[j]

Friend Edison

Sunday 2:30 P.M. 1st Test today. Loop to Harrisburg via Reading, 225 miles. Sup't Clute[17] of W.U. ofs there got us clear and distinct on a Phelps Magneto.[f][18] We heard his voice in responses but could not get any distinct word from him.

2d test 3:30 PM We had a single straight wire to Hbg via Reading 125 miles, grounded at Hbg. Supt Clute still there and got us with great and "surprising distinctness." I quote his words. He says "the result surprises me." We heard ~~him~~ musical notes from his Magneto in response but no audible words. He wired us subsequently.

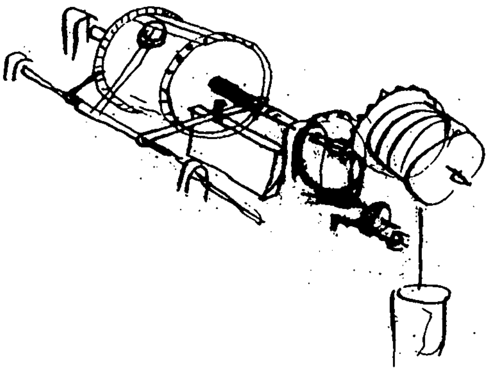
⟨W.H.P. I send you this letter to show you how we are getting along with the Carbon telephone Mr. B. conducts the experiments by order of Mr Orton as Prescott is[d] down on me & Mr. O. is aware of it Yours Edison⟩

ALS, UkLIEE, WHP. [a]Covered by ink blot. [b]Interlined above. [c]"10 inches" interlined above. [d]Obscured overwritten letters. [e]Canceled. [f]"or Electromotograph" interlined above. [g]Enclosure is an ALS on letterhead of Philadelphia Local Telegraph Co. [h]"Philadelphia," and "187" preprinted. [i]Enclosure is an AL on Philadelphia Local Telegraph Co. message form. [j]"187" preprinted.

1. This month brought William Preece's promotion to Electrician and Assistant Engineer-in-Chief of the British telegraph system. Baker 1976, 176–77; see also *TAEB* 3:159 n. 7.

2. On this same day, Charles Batchelor wrote to Baldwin Bros. & Co. to tell them he was sending them the phonograph via Jersey Express. Baldwin Bros. and Austin Baldwin & Co. were transatlantic shipping agents located at 72 Broadway in New York City. Lbk. 1:338 (*TAEM* 28:211); letterhead, Baldwin Bros. to TAE, 23 Dec. 1878, DF (*TAEM* 17:1111); Wilson 1878, 60–61.

3. No details of this clockwork are certain, but a January drawing may show the type of arrangment Edison used (Vol. 17:31, Lab. [*TAEM*



A clockwork cylinder design from January 1878.

4:900]). See also Docs. 1227 and 1310 for cylinder-phonograph clockworks and governors.

4. George Phelps's combination printing telegraph. See *TAEB* 1:62 n.1.

5. This refers to the first enclosure below.

6. Preece had spent more than two months in 1877 investigating telegraph facilities, equipment, and practices in the United States and Canada. Docs. 909 and 976.

7. That is, the Gray and Phelps magneto-transmitters using the principle patented by Bell.

8. Joseph Stearns invented the first commercially successful duplex telegraph (see *TAEB* 1:101 n. 3). Nothing is known of Preece's reported comments to Stearns.

9. This was a formerly thriving large commercial establishment on Regent Street, offering combined entertainments, popular scientific lectures, and technological "wonders." Both building and name would soon be sold, inaugurating London's modern polytechnic educational institutions. Altick 1978, 382–89, 504–5; Curtis and Boultwood 1966, 284.

10. Unidentified.

11. No. 2,909 (1877).

12. Unidentified.

13. See Docs. 1123, 1143, and 1172.

14. Not found.

15. Samuel Plush had been superintendent of the Philadelphia Local Telegraph Co. for about ten years. Plush's testimony, TI 1:342 (*TAEM* 11:148).

16. The "racket" (or crosstalk) was inductive disturbance of one wire's signal by signals on other wires. Telegraph lines arranged for quadruplex employed significantly greater battery power than simple circuits.

17. Probably H. A. Clute, telegraph superintendent for Lehigh Valley Rural Delivery, who had "in operation a telephonic line half a mile in length, with seven offices." *Operator,* 15 Feb. 1878, 8.

18. That is, a Phelps magneto-receiver.

-1205-

To Henry Edmunds, Jr.

Menlo Park NJ Feby 12, 1878[a]

Dear Sir

Unfortunately you addressed you letters to W.U Office and the stupid boy in Prescotts office only handed them to me today. A few days after you left I made arrangements with Mr Theodore Puskas for Telephone and[b] phonograph on the continent, he paying for the patents=[1] Heis arrangement did not include England. However he arrived in England some six days ago and Telegraphs If he can sell phonograph patent, and I telegraphed yes if price is satisfactory to me, that was two days ago[2] I have heard nothing since; but may do so at any moment He is stopping at The Langham Hotel, and has pair Telephones and 2[c] Phonographs= I have shipped Mr Preece a Phonograph which left on City of Montreal I will send you one immediately it is done. I am sorry that I could not have done something through you as you have been so kind= However I will put you in the way of something good presently= and should Puskas fail in his negotiations you might then come in to it, but as it stands my telegram commits me;[3] In this Country phono is booming and they are making applications on every side to different things= Await arrival of your machine and I will send you all the points for good Lecture with amplified tracings of the Lords prayer and other things= 475 feet is the distance attained now by using sheet[c] copper & speaking loud= The most astonishing thing about the whole thing is the great difference it makes whether the machine is turned by hand or by [c]controlled mechanism. with the latter the thing is perfect. I have dictated more than a dozen letters and Mr Batchelor copied them correctly without knowing previously their nature. attempts to do this with the hand turned machine was comparatively a failure, although to persons who heard it dictated it was plain. The Times article is first class and I thank you very much[4] please direct letters to Menlo Park N.J. Yours Truly

T A Edison

P.S. You might call on Puskas and you may do something with The Russian patent. Puskas is a good man & a gentleman.

ALS, Pritchard. Letterhead of Edison Electrical Pen and Duplicating Press, Charles Batchelor, General Agent for Foreign Countries. [a]"187" preprinted. [b]Circled. [c]Interlined above.

1. Edison signed his agreement with Puskas (and George Bliss) on 17 December 1877 (see Doc. 1153 n. 5). Edmunds had been at Menlo Park and had proposed that he become Edison's agent for the phono-

graph in Great Britain, but Edison had not agreed (see Doc. 1212). Edmunds had recently written renewing the request. Edison passed that letter on to Puskas; it has not been found (see Doc. 1208).

2. Puskas had cabled on 8 February and Edison replied the same day, but see Doc. 1200 n. 2 regarding another possible cable on this subject.

3. Henry Edmunds, Jr., son of an ironmonger/engineer, had met Edison while on a trip to the United States promoting Richard Werdermann's arc light. As a result of that trip he instead began promoting the Wallace-Farmer arc lighting system in Great Britain. When Edmunds met Edison is uncertain; most probably it was at Menlo Park near the middle of December 1877, rather than late November or early December as Edmunds claimed four decades later in his reminiscences. Although Tritton (1993) claims that Edmunds met Edison in August 1877 at William Wallace's shop in Ansonia, Conn., the description of that meeting is clearly derived from accounts of Edison's October 1878 visit after Edmunds had returned to Britain. Tritton 1993, 10–33; Doc. 1212.

4. "The Phonograph," in the 17 January 1878 issue of the *London Times* (p. 4), was subsequently reprinted in other British papers (one copy is in Cat. 1031:4 [*TAEM* 27:734]). According to Tritton 1993 (p. 36), the article was written by Perry Nursey, who acknowledged at the conclusion "that we are indebted for our information to Mr. Henry Edmunds, jun., of 57 Greenchurch-street, who has lately returned from a tour of scientific inspection in the United States and is interesting himself in Mr. Edison's inventions." In his answer of 26 February, Edmunds noted that the *Times* article "caused quite a sensation here in England" (DF [*TAEM* 15:288]).

-1206-

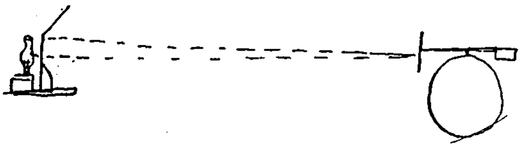
To Alfred Mayer

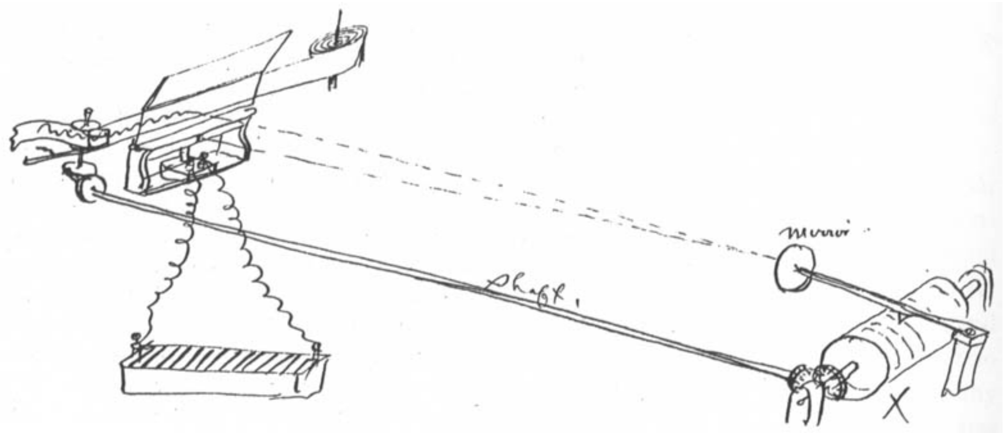
Menlo Park N.J. Feby 12 [1878]

Friend Mayer

I have just got phonograph running by power from the Steam Engine and its astonishing the difference is vast, especially in the music. I had taken great pains to get the belting & pulleys true & even hoping to better the results, but was astonished what a difference it makes to turn even or nearly so=[1] There is a slight chattering in the pulleys yet. You ought to come and see it= Have you an Engine at the Institute if so can give you the sizes of pulleys if you will give the speed of main shaft=

How would this do for amplifying the record[2a]



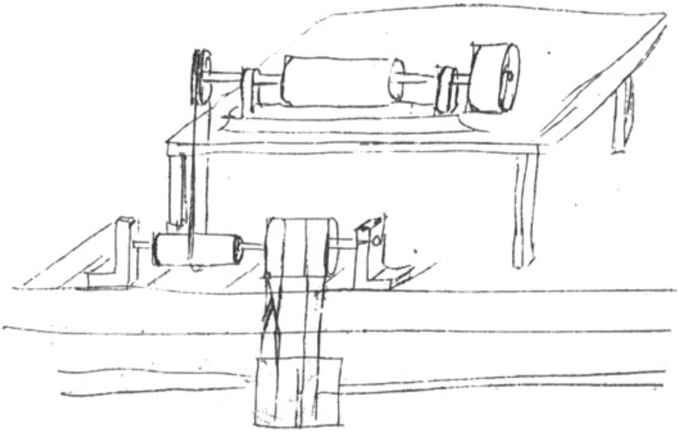


Either by photography running everything very slow,[3] or d[itt]o and follow the ~~spool~~ spot[b] (small round spot) of light by hand with a pencil the cylinder X being rotated by hand about 1 turn a minute; I suppose the shaft could be 30 feet long= Yours

T A Edison

P.S. Scribners artist[4] came today and made sketch of my telephone (speaking)—and phonograph Telephone sketch was elegant.[5] E

ALS, NjP, Hyatt & Mayer. [a]First sketch followed by "over" to indicate page turn. [b]Interlined above.



A phonograph connected to the steam-powered drive of the workshop at Menlo Park, with the belt coming up through the laboratory floor.

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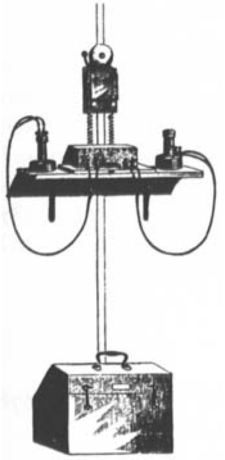
1. Edison had first publicly demonstrated the operation of a phonograph by steam power on 10 January. After telling a *New York World* reporter that "the irregular way in which the crank was turned by hand reproduced the sounds [of singing] in a jerky way, very much as a hand-organ," he "placed a pulley upon the axle, and from a belt attached to a lathe ran the phonograph in that way" ("Mr. Edison's Inventions,"

New York World, 12 Jan. 1878, Cat. 1240, item 327, Batchelor [*TAEM* 94:99]). An undated sketch shows a phonograph powered by the laboratory shafting (NS-Undated-004, Lab. [*TAEM* 8:201]). A similar arrangement is depicted in Doc. 1277.



This drawing of Edison's full telephone set appeared in the April issue of Scribner's Monthly.

2. That is, making the impressions of the recording stylus visible on an enlarged scale. Edison has drawn an electric light source and a roll of photographically sensitive paper, similar to the chemically sensitive paper he used for automatic telegraphy and the electromotograph. Mayer responded on 14 February, saying the "sketch of mirror &c is just what I am now constructing." In that letter he proposed a visit to Menlo Park on 19 February. He did spend a day with Edison, but exactly when is not certain. Mayer to TAE, 14 Feb. and 6 Mar. 1878, DF (*TAEM* 18:918, 935).

3. A few days later Edison drew the attention of another interviewer to reports that "instantaneous" photographs had become possible, and he suggested combining a rapid series of such photographs with a phonographic reproduction of the accompanying vocal or other sounds. "A Marvelous Discovery," *New York Sun*, 22 Feb. 1878, Cat. 1240, item 378, Batchelor (*TAEM* 94:115).

4. The *Scribner's Monthly* artist, J. F. Runge, came with a letter of introduction from A. W. Drake, the magazine's art editor, which indicated that he was to make drawings of Edison's phonograph for George Prescott (DF [*TAEM* 17:11]). Prescott's article on the phonograph and telephone, in which these drawings were used, appeared in the April issue (Prescott 1878a).

5. The sketch of the telephone is reproduced with Doc. 1194. Runge also drew a sketch of the complete Edison telephone set with transmitter, receiver, call bell, and battery box.

-1207-

To Theodore Puskas

M Park NJ Feby 12/78

Friend Puskas—

Just finished putting phonograph on power ie[a] I connected with my steam engine, with a carefully arranged series of pulleys & belts= The results exceed my sanguine expectations.[1] Letters can be dictated & copied with ease. The singing is beautiful in fact I am overjoyed and had no conception that there would be so marked a change The new plate machine I feel sure is going to be a perfect success= All the magazines have sent artists down here to make cuts for their papers=[2] The Hubbard Cheever party have ordered 500 of the small hand phonographs like the one I am making you= the demand for these are great= more anon— I sent contract yesterday & 3 letters— Yours

Edison

ALS, HuBPo, TP. [a]Circled.

1. Edison apparently expressed similar sentiments in a letter to George Bliss who replied that he was delighted "to hear that the phonograph is such a success with the power attachment." Bliss to TAE, 16 Feb. 1878, DF (*TAEM* 18:271).

2. To this date the preparation of illustrations only for *Popular Science Monthly* and *Scribner's Monthly* can be documented, although efforts were being made to arrange illustrations for the publisher Frank Leslie as well. It is not clear when the illustrations for forthcoming features in publications such as *Harpers Weekly* were prepared. Headnote p. 10; Doc. 1206; Frank Leslie's Publishing House to TAE, 7 and 12 Feb. 1878 and Alfred Mayer to TAE, 16 Jan. and 14 Feb. 1878, all DF (*TAEM* 17:9, 12; 18:910, 918); see also headnote p. 195, n. 1.

-1208-

To Theodore Puskas

MPark Feby. [13][1] 1878[a]

Friend Puskas;

Cheever at Telephone wants to take out Phonograph patents in South America=[2] Did I promise South America to you I forget[3] if so I think we had better secure them at once also, Sweden Norway, India, Portugal, and the three Australian Countries[4] would you authorize Serriell[5] to prepare the papers=[6] Since the power turned machine experiment last night I have a higher opinion of the phonograph than ever= the singing is beautiful= and no difficulty is experienced in copying anything dictated= please answer at once=[7] I enclose letter sent me by H.E.[8] the party who called on me at this place some time ago; I wrote him[9] that his letter came too late that you who had the whole thing had telegraphed ~~th~~about England and that had probably closed matter up. Yours—

Edison

US Patent for phono allowed!![10]

ALS, HuBPo, TP. Letterhead of Edison's Electrical Pen and Duplicating Press, Charles Batchelor, General Agent for Foreign Countries. [a]"187" preprinted.

1. Edison apparently wrote this on 13 February since he refers to the trial of a power-driven phonograph on the 12th as having occurred "last night," but the postscript may have been added on the 14th (see note 10).

2. No written record of this request has been found but some later materials connect Cheever with Frederick Jones and arrangements to exhibit the phonograph in Brazil. See Doc. 1317 n. 2; Charles Cheever to TAE, 13 May and 7 June 1878, DF (*TAEM* 19:237, 248).

3. The only arrangements that had been made thus far for marketing Edison's inventions anywhere in Latin America concerned the electric

pen. Although this letter was concerned with the phonograph, Edison's agreement with Puskas also involved the telephone. However, Vesey Butler (marketing the pen in Havana, Cuba) and James Partrick (partner with Franklin Carter in a Philadelphia firm of telegraph equipment makers) also each believed Edison had promised him the agency for Latin America. Partrick's letter of 11 February may have helped spur Edison to ask Puskas to clarify their understanding (Partrick to TAE, 11 and 14 Feb.; Butler to TAE, 5 Mar., all DF [*TAEM* 19:836–37, 840]). Various other parties also sought to represent Edison in the region. Edison did not resolve these questions for months, nor settle on any single agent, partly because it was unclear how much patent protection could be obtained (Lemuel Serrell to Theodore Puskas, 15 Mar. 1878, DF [*TAEM* 18:635]; "The Man Who Invents: Tom Edison's Talk with a Post Reporter," *Washington Post and Union,* 19 Apr. 1878, Cat. 1240, item 532 [*TAEM* 94:169]). Also see Docs. 1317 n. 2, 1368, and 1394.

4. Although under British sovereignty, India and the three Australian colonies of New South Wales, Queensland, and Victoria, like Canada, had separate patent arrangements.

5. Lemuel Serrell.

6. Puskas's authorization was needed for Edison to apply for these patents since, under the terms of his 17 December 1877 agreements with Edison and George Bliss, Puskas was responsible for paying the considerable costs. Efforts were already underway to obtain patents for Belgium, France, Spain, Italy, Austria-Hungary, Germany, and Russia, and Puskas had put $1,260 on account with Serrell primarily for this purpose, although Puskas ultimately decided not to order the Spanish and Russian phonograph patents which each would have cost $300. The cost for the patents mentioned in this letter was estimated at $1,500, plus $395 for Denmark and the Cape of Good Hope. Another $1,300 to $1,900 was estimated for Latin America. Agreements between TAE, Puskas, and Bliss, 17 Dec. 1877, Kellow (*TAEM* 28:1195, 1204); Serrell to Puskas, 15 Mar. 1878; Serrell's "Memorandum of Charges for Foreign Patents," May 1878; Serrell to TAE, 8 Nov. 1878; and Serrell's bills to Puskas, 8 Nov. 1878, all DF (*TAEM* 18:635, 708, 795–98).

7. On 2 March, according to Charles Batchelor's diary (Cat. 1233:61, Batchelor [*TAEM* 90:83]), Puskas cabled Edison to "instruct Serrell to secure remaining patents" (DF [*TAEM* 15:277]). This cable is indexed under "Unknown Correspondent" and dated 25 February (conjectured by an archivist) in *TAEM-G1*.

8. Henry Edmunds, Jr., whose letter has not been found.

9. Doc. 1205.

10. Allowance meant that the application had passed technical and legal muster and that the patent would be issued if the necessary fee was paid. Edison was informed of the allowance in Uriah Painter's letter of 13 February (DF [*TAEM* 15:236]); depending on when Painter mailed the letter, Edison would have received it on either the 13th or 14th. U.S. Patent 200,521 was issued on 19 February 1878.

-1209-

To Foster & Thomson

[Menlo Park, c. February 14, 1878][1]

Copy

Gents.

There is no secret about it. Several months ago I transferred the patent to Geo B Prescott Gerritt Smith & William Orton lastly.[2] I have a small interest in it but too small to worry over its loss; Considering that your friends have a valid contract (when I receive the Consideration) for the Auto ~~& cable system~~ system & option on Cables 2 systems that if introduced now would be in advance of their time I think it will not pay them to set up the claim[3] they do & thus give rise to bad feeling & prevent the perfection of these systems. Yours Truly

T A Edison

ALS (copy), NjWOE, DF (*TAEM* 19:477). Letterhead of Edison Electrical Pen and Duplicating Press, Charles Batchelor, General Agent for Foreign Countries.

[1] Edison was responding to Foster & Thomson's letter of 12 February in which they indicated that they had received a note from him but not his promised visit and asked for information about the assignment of his quadruplex patent (DF [*TAEM* 19:463]). On the same day, Josiah Reiff sent Edison a copy of the 1873 contract with Smith, Fleming & Co. (Doc. 350) that was at the heart of this dispute and also sent that firm a long letter stating what he believed to be Edison's case (DF [*TAEM* 19:462, 466]).

[2] See Doc. 1173 n. 9.

[3] See Doc. 1165 n. 5.

-1210-

From Josiah Reiff

NY Febry 18/78

T.A.E.

Advise me how long it will[a] probably take you to experiment on your scheme for utilizing engine whistles, Fog horns etc etc for speaking purposes—[1]

I have a plan in view if you are ready—

What claim has this man James upon you?

Did he ever put any money in your pocket? Yrs

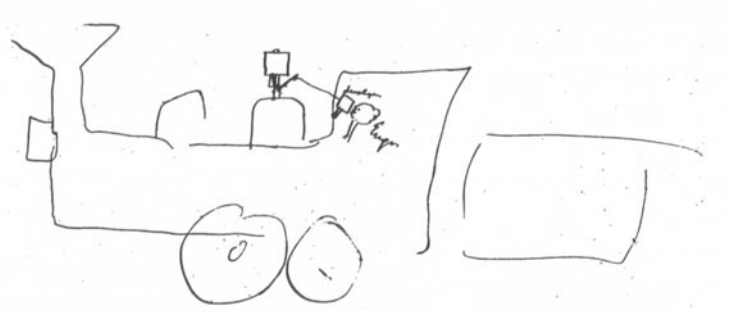
J C Reiff

P.S. When next in town I should like to shew you the letter I addressed to Smith, Fleming & Co. in reply to the one I shewed you from them.[2]

ALS, NjWOE, DF (*TAEM* 15:245). [a]Document damaged.

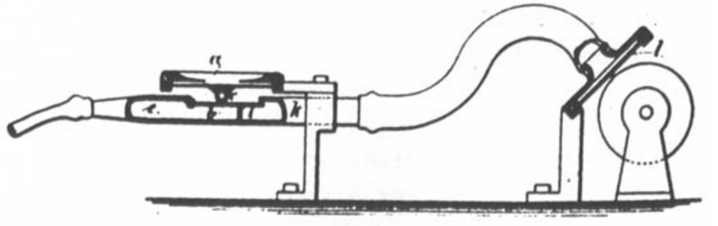
1. Edison had included this idea as part of his original patent application for the phonograph.

> For increasing the volume of the sound and thus rendering it audible to a large audience I cause the diaphragm set in motion by the speaker to work a valve which controls a gaseous source of power such as compressed air or steam, which is caused to act powerfully upon a second and larger diaphragm which makes large or broad and deep indentations, which cause the reproducing spring to give great amplitude and thus the sound is reproduced more powerfully than that of the original speaker.



Edison's sketch of a "steam telephone" based on his aerophone.

On 26 January, the patent office told him to separate this design from the phonograph patent, and Edison executed a new application for what he termed the "aerophone" on 28 February; the patent was filed on 4 March and issued twenty-two days later (U.S. Pat. 201,760). The name "airophone" was first applied on 17 January in a drawing by Edison of a steam telephone for railroad signalling that used a similar valve and compressed air design (Vol. 14:15, Lab. [*TAEM* 4:162]). For earlier designs of telephones and phonographs using compressed air or gas see Docs. 948 and 1013.



A drawing from Edison's U.S. Patent 201,760 for the aerophone.

2. The letter from Smith, Fleming & Co. to Reiff has not been found. On 20 February, Reiff responded to a request from Edison by sending him a copy of his 12 February letter to the company concerning their claim on Edison's quadruplex patent rights for Great Britain. Reiff to TAE, 20 Feb. 1878; Reiff to Smith, Fleming & Co., 12 Feb. 1878; both DF (*TAEM* 19:465–66).

-1211-

Edward Johnson Exhibition Prospectus

New York, Feb'y 18th, 1878.[1]

Dear Sir:

Having secured the sole right to Exhibit the various Telephonic and Phonographic inventions of Mr. Thomas A. Edison and having arranged with him to receive simulataneous with its production any improvement incidental to their development, I am prepared to inaugurate a Series of Exhibitions, instructive and entertaining to a superlative degree. In point of fact rarely if ever equalled in its power to attract and interest all classes of an intelligent Community.

My present Outfit includes the following:

Edisons Speaking Phonograph.
Edisons Musical Telephone.
Edisons Speaking Telephone.[2]

Each of which are unequalled in respect to their capacity to perform the work for which they are designed.

The Speaking Phonograph.

This invention, an absolutely new discovery, I place first in order, because it is unquestionably the most important in its beneficent effect upon the progress of Science and human industry, of any invention of late years. Such is the verdict of the many eminent Scientists who have examined it.

By it I will entertain an audience as follows:

Recitations, Conversational remarks, Songs (with words) Cornet Solos, Animal Mimicry, Laughter, Coughing etc, etc, will be delivered into the mouth of the machine, and subsequently reproduced by the machine with such fidelity of tone, Articulation, Emphasis, etc, as will kindle an enthusiasm as hearty as it will be spontanious, and by reason of the simplicity of the apparatus, a clear and concise explanation of which is given—carry conviction at once to all that the Apparatus is really a great discovery and not a mear trick or toy for producing deceptive effects— the known reputation of Mr. Edison as a producer of practical inventions is however the best guarantee I have to offer of the genuinness of this great discovery.

The Speaking Telephone.

This invention I rank next in order because of its relative commercial value and Scientific interest, though for purposes of public Exhibitions & entertainment it is not well adapted by reason of the fact that the volume of sound it gives is too limited for contributing enjoyment to a large Audience. In order however to illustrate the practical use of the Speaking Telephone in a striking manner I use this Instrument in the presence of the Audience to direct my assistant at the farther end of the wire as to the order of the musical programme, for transmitting to him encores, and otherwise to keep him and the Musical Artists advised as to the pleasure of the Audience.

The Musical Telephone.

This invention is the most novel and has far greater capacity for interesting and entertaining an audience than all the Telephonic devices of other inventors combined. It is not operated by an Electro magnet as are all other Telephones, but upon an entirely new principle of Electro-Chemical action, pronounced by Eminent Scientists as an original discovery in the Electrical Science, the capacity to reproduce and make clearly audable Telephonic (Musical) sounds given to this Instrument by this new principle renders it absolutely the only apparatus in existence by which vocal and cornet solos can be transmitted from a distant point to an Audience Hall and there reproduced in a manner at once readily heard by all, however many there may be, and in an enjoyable manner.

The Explanatory Lecture.

This part of the Entertainment is made to suit the spirit and humor of the Audience, but it is mainly confined to clear, simple, explanations of the Modus Operandi of the several apparatus, and if apparently satisfactory, to a very brief sketch of the history of the development of the inventions. No scientific dissertation on the Laws and theories of Sound, or other prolix and tedious consumption of time by the Speaker— My object is simply "to show and make intelligible what I show." As to the details for your guidance in the preparation and advertizement of my entertainment I submit the following general directions.

Order of Programme.

1st Part.[a] The Musical Telephone, with Speaking Telephone as auxillary.

2nd Part[a] The Phonograph.[b]

Specific Directions=

Telegraph Line—

Length of Line which may be operated 1 to 100 miles.

Battery required for its operation 20 to 100 cells.

Conditions essential. A wire absolutely free from Telegraphic apparatus—a single wire connecting the Hall with the main wire—a Looped wire to connect the singing station with the Telegraph office—or Battery.

Permission for the free use of wire and battery can generally be had by application to the W.U. Telegraph officials they having always exercised a commendable public spirit in this regard, especially in relation to Mr. Edisons improvements: Railway Companies may also be applied to effectively.

Musicians.

At the Singing Station.

1 Tenor. 1 Soprano. 1 Cornet Soloist. all of the best to be had as the apparatus shows the execution of the Artist. A greater number of artists are an impediment.

In selecting Artists regard should be had to their reputation in the City in which their voices are reproduced. Their style of execution is frequently recognized, which has a telling effect. The Soprano especially should be of a high order of merit. These Artists can usually be had as volunteers, they being attracted by the novelty.

The Phonograph.

This being a purely mechanical apparatus and hence operated locally does not require the use of wires etc. I therefore make it the second part of the entertainment, thus dismissing the singers, and yeilding up the wire at an early hour—usually about 9.15. P.M. I require for its proper exhibition no paraphenalia of any sort—and only a good singer and Cornet player to sing and play into the mouth of the Machine, upon the stage in presence of the Audience. These are not indispensable but they add to the attractiveness of the Exhibition.

Advertizing.

The large Posters should have prominently the general features hearin contained—but small hand bills should set forth in considerable detail the points made—and be well distributed. The Local papers should insert as squibs the various points and comments as to the fulfillment of these promises culled from papers where I have exhibited—such a course of advertizing invariably pays largely.

I usually reach the City several hours in advance of the opening of the entertainment and make a preliminary test or rehearsal as early as the wire can be obtained. It is well to have reporters present at this rehearsal.

My terms are $100 per night—and comprehend all the necessary apparatus, myself and one assistant.

I carry 1000 feet of Insulated office wire for connecting my instruments with the outside wire previously brought to the Hall window.

On selecting the Singing Station first ascertain if Battery is obtainable—

Any small room handy to the Battery or Telegraph Office suffices for the Singing Station   Yours Very truly

Edwd H. Johnson

THIS IS WRITTEN WITH ONE OF MR. EDISON'S CELEBRATED INVENTIONS, THE ELECTRIC PEN.

ALS (electric-pen copy), NjWOE, DF (*TAEM* 97:623). [a]Underlined twice. [b]Followed by centered horizontal line.

1. Johnson apparently sent this circular letter with another one he wrote the following day:

> Will you be good enough to put the enclosed in proper hands to accomplish the end sought, which you will observe, is to give you a Telephone and Phonograph Exhibition.
>
> My tour commences at Syracuse, N.Y. Feb'y 28th hence prompt replies to my Circular are desirable. After that time I will be on the road, and can be reached only by Telegraph. [DF (*TAEM* 15:254)]

2. Batchelor may have made a special box for Johnson in which to carry the speaking telephone. See crossed out memo on "Defendant's Exhibit Sketch Clock Phonograph Feb. 20/78," *American Graphophone v. U. S. Phonograph* (*TAEM* 116:455).

-1212-

To William Preece

Menlo Park N.J. Feby 19= 78

Friend Preece,

Yours reced dated Feby. 6=[1] Glad to hear you made phono go=[2] ere this letter reaches you the improved phonograph will have reached you=[3] Use thick foil very smooth= bass tone= lips close to hole= The articulation is dependent on how the diaphragm is dampened by the rubber tubes= when it dont speak plain look to these tubes= I forget if I sent you instructions or not= To[a] day by using a very thick hard foil—very smooth a proper point agate= and a good governor on the clockwork, I finished the articulation. I can never hope to get it to speak plainer= its perfection and the voice is recognized, but the slightest difference in the speed you lose thise recognition but the talking still seems[b] as plain=

Solid Cylinders of polished lead receive[b] the indentations & reproduce beautifully= Iron not so clear owing to noise, due to imperfect surface[c]   a Bell telephone with a pointed pole held near indentations in iron cylinder gives talking but not good=[4] I am making a glass cylinder over which thick foil is laid indenting without grooves=[d] Note= streatch foil on your cylinder tightly= =[e] Phono talking is better through[5] a telephone line= This evening I found out something good= when the machine runs by regulated power the singing is sweet, by turning cylinder backwards[f] the song is still melodious in many cases, and some of the strains are sweet and novel, but altogether different from the song reproduced in the right way Wagner hasnt the monopoly of the music of the future=[6] Im going in to the machine composing business Just think of it "Faustus, backwards by Edison in 56 sheets= phonographically price 30 cents for sale by all dealers in phonograph materials=

A good thing to recite in the phono is A soldier of the Legion lay dying in Algiers"[7] etc= About my agents= Edmunds came down to my laboratory & saw phono wanted to take it to E[ngland]. wouldnt let him= I gave him some strips told him the first phono I could spare would go to you & told him call on you= Beetle is electric pen man on Continent hasnt anything to do with phono or telephone= ~~Pu~~Herz was a fraud and failed to pay for the patents= Puskas stepped in paid for the patents & has the Continent for Phono & Telephone= Puskas has no contract with me in England I told him when he asked me if he could ~~sell~~ stop in London & sell phono that he might= As to telephone I have made no arrangement with any person except you and you shall have the say=[8] If I hadnt thought the phono was outside of your line you could have had that too= Im going to ship you pair telephones monday next[9] ~~but I reserve~~ for your private experimental use= They are not‸as perfect as I am going to make them but for rough work I think you will find them OK= If you find anything wrong with them reserve your criticism & decision until I make them OK= Im going to have the best telephone or Ill eat all Ive got=

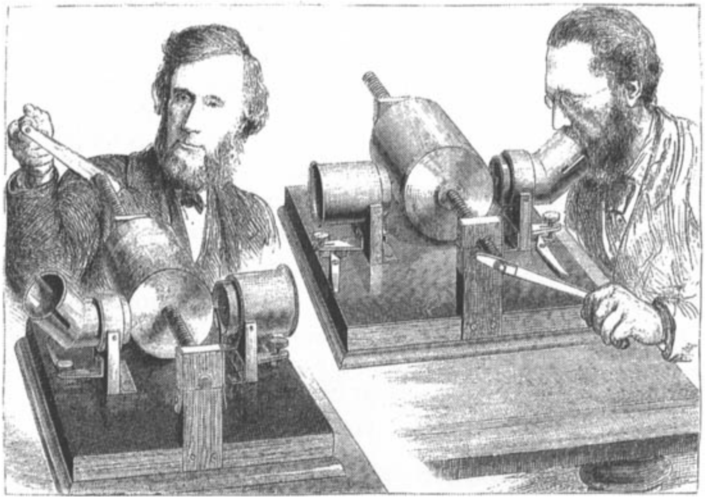
Prof Mayer of Hoboken one of the best of acousticians, I giving a thorough scientific investigation to the phono he will have an article in the March or April No of the popular Science Monthly and is going to send cuts (15 of them) to Nature=[10] he has amplified the phono records, and has cuts of the sinnoids[11]—get it= He says Phono is an instrument of precision as you can now verify your records= That deep and sonorous Savan Mr Prescott, (inventor) is writing an article on telephones in the Scribner's Monthly—that will be out in March or April=[12] get it= Its fully illustrated and exparte—By Prescotts advice the W.U. have stolen the Bell Telephone Entire=[13] Yours

T. A. Edison

ALS, UkLIEE, WHP. [a]Preceded by a right bracket in another hand, probably added later. [b]Obscured overwritten letter. [c]"due . . . surface" interlined above. [d]"=" overwritten by a left bracket in another hand, probably added later. [e]Second "=" overwritten by a right bracket in another hand, probably added later. [f]Underlined twice.

1. Not found.

2. Preece had demonstrated the phonograph at one of the Royal Institution's Friday night lectures on 1 February 1878. He had used an approximate replica of the first phonograph, constructed in London on the basis of descriptions provided by Henry Edmunds and found in publications such as the *Scientific American* and *English Mechanic* (Docs. 1144 and 1150). A published report of the session was illustrated by drawings of the phonograph being operated by Preece and John Tyndall, who was the Institution's professor of natural philosophy ("The Phonograph at the Royal Institution," *London Weekly Graphic,* 16 Mar. 1878, Cat. 1031:71, Scraps. [*TAEM* 27:774]).



John Tyndall and William Preece demonstrating the phonograph at the Royal Institution.

3. That is, the phonograph similar to Doc. 1166 sent to Preece a week earlier (Doc. 1204).

4. Two weeks earlier Edison had been considering the "queer idea" of playing back iron-foil recordings "by magnetic attraction without touching." Vol. 17:46 and NS-78-007 (misidentified on *TAEM* as NS-78-001), both Lab. (*TAEM* 4:915, 168:552).

5. Edison probably inadvertently omitted "than" before "through."

6. The composer Richard Wagner was widely known, and criticized, for his claims that his own work exemplified the appropriate future direction for music. See, e.g., the 19 May 1877 caricature of Wagner in the popular magazine *Vanity Fair,* titled "The Music of the Future." *NGD,* s.v. "Wagner (1) . . . (Wilhelm) Richard Wagner."

7. The line quoted begins the poem "Bingen on the Rhine," by Caroline Elizabeth Sheridan Norton.

8. They had apparently arranged the previous summer for Edison to provide examples of his telephone instruments to Preece, who would act as Edison's agent to introduce them into Great Britain. See Docs. 987, 1077, 1123, and 1348.

9. This was written on a Tuesday. However, Edison did not send telephones to Preece until a month later when James Adams took some with him. Doc. 1258 n. 2.

10. See Doc. 1203 n. 1.

11. That is, engravings of enlarged tracings of the indentations of a tinfoil recording.

12. The article (Prescott 1878a) was in the issue for April, which appeared by 20 March (see ad for *Scribner's Monthly* and notice of newly appearing magazines, Cat. 1031:43, 50, Scraps. [*TAEM* 27:755, 758]). The article was essentially an extract from the book that George Prescott was then finishing (Prescott 1878c), although the text of the book was somewhat updated before publication.

13. In his book on the telephone, Prescott concluded that Alexander Graham Bell was not the first inventor of the telephone and that the best claim was that of Elisha Gray. He summed up his brief analysis (after presenting extensive documents provided by both men): "Whether or not Prof. Bell invented the apparatus independently of Mr. Gray, we have no means of judging; but that he was not the first inventor, we think the facts conclusively show" (Prescott 1878c, 217). Western Union had secured the rights to Gray's patents and claims in telephone matters through the American Speaking Telephone Company (Doc. 1126 n. 1). When Prescott revised and updated his book after Western Union dropped its telephone claims in a general settlement with the Bell interests, he presented different evidence and arguments and no longer included his earlier conclusion favoring Gray's claim (Prescott 1972).

-1213-

From George Bliss

Chicago, Feb. 22nd, 1878.[a]

Dear Sir:

Your note of the 19th Inst at hand.

J. F. Bailey[1] left here yesterday for the east and will start at once for Europe to represent the Gray telephone interests.

He is said to be a smart fellow who has had large experience in organizing companies.

The plan is to force the telephone situation abroad into about the same shape as in this country. The conversation with me has been however that they care little about the Bell interest but would like to secure a combination with you. I gave Bailey a letter to Puskas stating who he was &[b] saying you did not favor an alliance but if he could see a handsome amount of money in combination I thought it would in that case be desirable.

Whatever is done it will be better for Puskas to meet Bailey and know his man. I should like to have you send me Puskas address so that he can be written and be made acquainted with all the facts.

I gave Bailey a letter to Beetle to substantially the same effect.

You understand thoroughly that I have no desire in the matter except in accordance with what seems best to you. On general principals I believe in compromise rather than[c] enter into an expensive contest which may ruin the chances of all.

The plan on which Puskas is working looks splendid and if the concessions are obtained with the best telephone it would look like a scoop.

Great Brittain was not included in the contract in which I am interested. Are you going to allow me any show there in the phonograph and telephone?

I am just now engaged in a squabble with the Western Electric people over my old Geo. H. Bliss & Co.[2] matters. They are so fearfully hoggish I fear it will lead to a complete separation of my interests from them.

I am a great fellow for comprimise but I don't like to have[c] all my pile schemed for and taken without even the show of protest.

I think this will lead to a settlement of your account in full or nearly so. They don't want that pen contract cancelled. There is no great loss without some small gain and you will get the benefit in this case.

The reason the royalty was so small last month in reality was because my orders were not filled. In justice to the W.E. I will say they have a large lot of goods in the shop and they are trying to do good work and fill the orders with reasonable promptness.

How is the telephone union with Bell progressing? Do you think it will go through?

I showed up the pen to the Chicago Electrical Society[3] last night. The evening was stormy and the attendance was small but I think the telegraphers will have a better idea of who and what T. A. Edison is than they ever had before.

The pen business is not coming up to my expectations and I don't see why with the amount of hard work I am putting in to it that the results do not pan better.

I am putting out heavier advertisements and doing more general work than ever before.

Think the general quiet times has much to do with it.

It is possible I may come down to New York next week but do not want to go if can be helped. Wheeler[4] is so dilatory about his reports that I can't stand it much longer.

Beetle is getting very remiss and I shall have to devise some way to stir him up if he don't reform.

Respectfully,

Geo. H. Bliss Gen. Man.

TLS, NjWOE, DF (*TAEM* 15:263). Typed in uppercase. Letterhead of Electric Pen and Duplicating Press, George Bliss, General Manager; letterhead and dateline are electric pen copy. [a]"Chicago," and "1878." preprinted. [b]Handwritten. [c]Interlined above in handwritten uppercase.

1. Nothing is known about Joshua Franklin Bailey apart from his several years association with Edison in regard to the marketing of his inventions in Europe, which began at this time. Bailey had written Edison on 7 February to inform him that "by a recent arrangement I represent Mr. S[amuel] S. White and Mr. Elisha Gray in Telephone & other matters, outside the U. States. I would like to meet you when you are in town this week, on what may prove of mutual advantage." Edison replied on 12 February inviting him to Menlo Park and Bailey wrote from New York on 18 February that he would come to Menlo at the end of that week or the beginning of the next (following his return from Chicago). Bailey to TAE, 7 and 18 Feb. 1878, DF (*TAEM* 19:836–37).

2. This was Bliss's old telegraph manufacturing firm which he sold to Western Electric. See *TAEB* 3:255 n. 8.

3. On 18 February, Bliss sent Edison a copy of a program for the meeting (printed with an electric pen). Underneath the notice that Bliss was to exhibit the pen he typed "Will my phono. be here in time for this?" Edison apparently wrote Bliss that the phonograph would not arrive in time as on 20 February Bliss replied, "Shall get along without the phonograph and think will be able to say quite enough about Edison and the electric pen for one evening." DF (*TAEM* 18:272–74).

The Chicago Electrical Society, founded in June 1876, was an auxiliary of the American Electrical Society, which had been established in Chicago in 1874. According to a report in the 16 March issue of the *Journal of the Telegraph* (11:82), Bliss presented "an explanation of the Electric Pen, prefacing his remarks with a brief synopsis of the life of its inventor. All present had a general knowledge of the working of the pen, but few, if any, were thoroughly acquainted with its mechanism. Mr. Bliss's effort was well received."

4. William Wheeler had been a general agent for Edison's Electric Pen and Duplicating Press in Chicago and at this time was working as the General Eastern Agent at 20 Church St. in New York. *TAEB* 3:410 n. 2; Wheeler to TAE, 2 Mar. 1878, DF (*TAEM* 19:839).

-1214-

From Gardiner Hubbard

Washington, D.C. Feby 22 1878[a]

Dear Sir

I have requested one or two parties to say to you that I thought Prof. Bell with his English Co[1]— could do better with your Phonograph than any one else, & if you think so I should like to know on what terms he could have it & I would then communicate with him—

Prof Bell has a high regard for ~~E~~Mr Edison as a most accomplished Electrician, & wonderful genius—

I trust our Phonographs are coming on—& that soon we can introduce them to the world— I am yours truly

Gardiner G. Hubbard

ALS, NjWOE, DF (*TAEM* 97:629). Letterhead of Bell Telephone Co. [a]"Washington, D.C." and "187" preprinted.

1. At this time, Alexander Graham Bell and William Reynolds, a Providence, R. I., cotton broker who had acquired an interest in Bell's British patents, were negotiating with a group of capitalists who would soon form the Telephone Company, Ltd. in London. Bruce 1973, 231, 238, 243–45.

-1215-

Technical Note: Telephony

Menlo Park NJ February 22 1878

Some directions for conducting empirical experiments in Telephony a voyage of discovery into the unknown.

1 2[1]

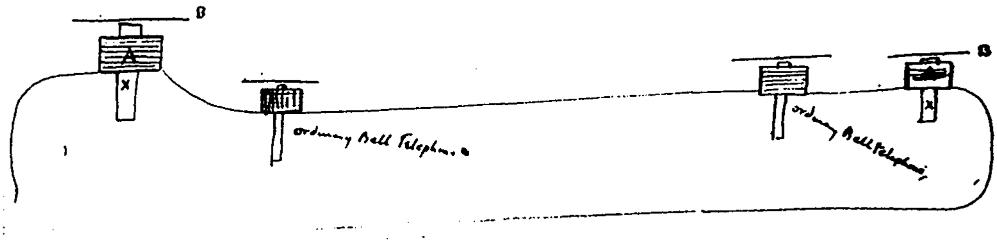
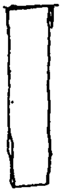


Fig. 1.
B diaphragm, or various kinds
A 50 ohm Telephone receiver spool.
X a glass tube with very thin glass

Fig 2
A 50 ohm Telephone spool.
B dia of various kinds
X glass Tube.

Make cores to replace glass tubes of Copper Zinc Tin Brass Lead cast iron, Cadmium aluminium Black oxide manganese; battery carbon— Lamp black plumbago, Bismuth antimony, celluloid— Hard rubber; Fused chloride zinc d[itt]o Nitre—do. Sulphate Copper; do every salt that will fuse or mould—do every substance in Laboratory that will mould

Make a mould that will mould this size[2]



In glass tube pour every kind of Liquid in it in Laboratory and hold perpendicular; try and receive from a Bell telephone with common diaphragm then change all kinds of diaphragms below described[3] if all a failure try and transmit to a Bell Telephone & make all the changes; Thus the 1st experiment is to see if you can use it as a receiver from a Bell Telephone & the second experiment is to see if you can use it as a transmitter using the Bell telephone as a receiver= use diaphragms with points of various substances ~~also~~[a] dipping in liquid also not dipping—

X, NjWOE, Vol. 14:44, Lab. (*TAEM* 4:185). [a]"with points . . . substances ~~also~~" interlined above.

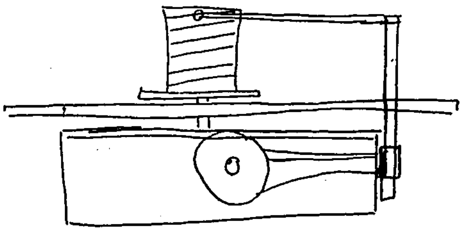
1. Text at each end of the drawing is "ordinary Bell Telephone."
2. The original drawing is roughly 8 mm × 32 mm.
3. This document may be incomplete, as no list of diaphragms has been found. A set of experiments, labeled "chemical cores," in which nearly one hundred different substances were tried commenced on 2 June after Charles Edison arrived at the laboratory and became the principal telephone experimenter, replacing James Adams who was in Europe. Some of the notes indicate that various diaphragms were tried as well. These chemical experiments continued through the first three weeks of June (see Docs. 1352, 1357, and 1359). Vol. 14:103–4, 111–19, Lab. (*TAEM* 4:248–52, 259–70); for earlier experiments with Bell-style receivers with alternative diaphragms see Docs. 1114, 1123, and 1186.

-1216-

Technical Note: Phonograph

[Menlo Park,] Feb 22nd 1878[1]

Phonograph[a]
Speaking ~~t~~attachment for clocks[2] Drum 4⅛diam[b]



T A Edison
J Kruesi

Chas Batchelor
G E Carman
M. N. Force

X, NjWOE, Lit., *American Graphophone v. U.S. Phonograph*, "Defendant's Exhibit Sketch Clock Phonograph Feb. 22/78," (*TAEM* 116: 456). Written by Batchelor. [a]Followed by double horizontal line. [b]Followed by horizontal line.

1. Batchelor later testified that he spent all day working on talking-clock and toy phonograph designs, but only this drawing survives. He also made a set of drawings on 20 February which represented "a general view of the cylinder with its accompanying screw-thread attachment for traversing, and the reproducing cup for giving out the sound." In his testimony, Batchelor claimed that he and Edison made extensive experiments before turning the clock phonograph work over to the Ansonia Clock Co. Something of this work is described by Edison in a marginal note on Isaac Davis's letter of 28 March: "The cylinder is merely the first experimental form 11 different kinds have since been made some with sheets some with continuous rolls. You must not infer from the first experimental machine that nothing has been done." Batchelor's testimony, pp. 597–99, 624–25; "Defendant's Exhibit Sketch Clock Phonograph Feb. 20/78," both *American Graphophone v. U. S. Phonograph* (*TAEM* 116:455, 372–73, 386); DF (*TAEM* 18:967).

2. Batchelor described the actual machines as "quite small, with the cylinder at one side of the clock-work, where the record could be put on to the cylinder and taken off and another record put there if required. The whole machine was to be made complete, and then the record, made on another machine, placed on the cylinder after the whole was assembled. These records were different, inasmuch as one would say one thing, and another another thing." He noted that "the drum projected outside of the clock-work . . . for the purpose of slipping on the recorded tablet and slipping it off if necessary without disarranging any other parts of the mechanism." The recordings were made on sheet copper

> originally in the form of a strip about twelve inches long and five-eighths of an inch wide. This was bent into the form of a circle of the size of the drum on the recording instrument. A short piece at each end was bent down to fit into a small groove running across the face of the recording drum. This was then put onto the drum and a rubber-covered rod pushed down into the groove securing the two ends against the side of the grooves similar to the method of fastening on the first and second cylinder instruments when they were used for tin or other foils. After this cylinder was engraved on the recording instrument the rubber-covered rod was pulled out, leaving the record-tablet so that it could be slipped off the end of the cylinder. This was now slipped onto the smooth cylinder projecting out of the clock-work, fastened in the same manner as when recording, and it was ready for use. [Batchelor's testimony, pp. 597–99, *American Graphophone v. U. S. Phonograph* (*TAEM* 116:372–73)]

-1217-

From Fifth Avenue Baptist Sunday School

New York, Febry 23′ 1878[a]

At the close of this mornings session of the 5′ Ave Baptist Sunday School[1] the following resolution was read and approved viz:—Resolved

"That the Secretary be requested to convey to Mr Thomas A. Edison and his assistant the cordial thanks of this School for their valuable assistance in the very interesting entertainment of Thursday evening last"[2]

George Vaughan Jr Sec'y

L, NjWOE, DF (*TAEM* 15:265). Letterhead of Fifth Ave. Baptist Sunday School. [a]"New York," and "187" preprinted.

1. This was an organization of the Fifth Avenue Baptist Church (at 46th St.), which was described as "a handsome and imposing edifice, that is always well attended." Browne 1869, 652.

2. Edison agreed to exhibit his phonograph and telephone at the behest of telegraph pioneer and author James Reid, secretary of both Gold and Stock Telegraph Co. and American Speaking Telephone Co., one of the most highly respected people in the telegraph industry (Reid to TAE, 7 and 19 Feb. 1878, DF [*TAEM* 15:230, 17:13]; on Reid see Reid 1879, passim). The exhibition took place on 21 February with Edison demonstrating his phonograph and telephone as part of a concert at the church. According to an account in the *New York Herald,* which failed to mention Edison by name,

> The inventor put his mouth down to the barrel and turned a handle as he spoke into the instrument in a loud voice, "A soldier of the legion lay dying at Algiers." In a moment after a click was heard; he applied a sort of funnel to the barrel and turned the handle. Immediately the machine recited the lines he had spoken, not very clearly, but like a person who had no pallet would speak. ["Phonograph and Telephone," 22 Feb. 1878, Cat. 1240, item 375, Batchelor (*TAEM* 94:114)]

Other experiments, presumably the recitations and songs scheduled in the program, were deemed "more successful."

The telephone exhibition included a transmission by Charles Batchelor from the Western Union headquarters (at Broadway and Dey streets). He transmitted "Mary Had a Little Lamb" to the tune of the "Mabel Waltz" and recited Edison's favorite line from *Richard III,* "Now is the winter of our discontent." Cat. 1233:52 and "Phonograph and Telephone," *New York Herald,* 22 Feb. 1878; "The Phonograph and Telephone Programme," Cat. 1240, items 375, 377, both Batchelor (*TAEM* 90:79; 94:114).

Among those who saw the exhibition was Albert Hale, who taught school in Tarrytown, N.Y. After the exhibition, Edison explained in detail how his phonograph and telephones were constructed and operated and he offered to send Hale a tinfoil recording from the phonograph for use in his class. On 28 February, Hale wrote to thank Edison for the tinfoil recording and suggested that he try a porcelain or earthenware funnel "to avoid that harsh metallic sound which the instrument gives to the words now." Edison's marginal note for use by William Carman in replying to Hale states: "That he [Edison] has now obtained perfect reproduction—& that your suggestion of a porcelain funnell is good he will try it and thanks you for the suggestion." Hale to TAE, 22 and 28 Feb. 1878, DF (*TAEM* 18:921, 930).

Edison also received an inquiry from Frank Scott of *Scribner's Monthly,* who upon hearing about the exhibition asked if Edison "could give a similar entertainment for the benefit of Presby Memorial Church 53d St. and Madison Ave." Edison replied that he planned to make available small exhibition phonographs and Scott indicated that he would "await with interest the appearance of the small inexpensive instruments." Scott to TAE, 18 and 21 Feb. 1878, DF (*TAEM* 15:246, 259).

-1218-

From George Beetle

Paris Feb 24th 1878

Friend Edison

Yours of the 10th recd today.[1] I shall take occasion to conform to your request so far as Mr Brequet is concerned. you need not expect much sympathy in that quarter, as he is Bells manufacturer and in the latters interest.

Roosevelt (Cornelius)[2] Bells agt in France informs me that Bell took out a new patent on the 8th in Washn and on the 12th in Paris,[3] this he thinks will hold as there was not time for the thing to become public property.

For your own protection hereafter I would suggest that you procure your patents in the US and in Europe as nearly together as possible, and do not place a description of future inventions before the public until you know that your foreign patents are secured. I will send you an extract from the French patent law in a few days,[4] a literal translation of which would in my opinion kill your Electric Pen patent in France and might possibly compromise the Telephone and Phonograph.[5]

I am giving a little attention to patents, not from choice but from[a] necessity. I am afraid we shall have to manufacture in Belgium to protect your "Pen" patent. Mr Brandon[6] acknowledges that the situation is serious. I shall know more definitely in a few days.

I hope to show progress in Electric Pen matters ere long.

Where is Mr Paskas? Report says that he has been in London for over 2 weeks, I have seen nothing or heard nothing direct from the gent Very truly

Geo L. Beetle

ALS, NjWOE, DF (*TAEM* 15:272). [a]Interlined above.

1. Not found.

2. Cornelius Roosevelt, Hilborne Roosevelt's brother, had acquired an interest in Bell's French patent the previous fall and had been in Paris since December. Bruce 1973, 246; Hilborne Roosevelt to TAE, 19 Apr. 1878, DF (*TAEM* 15:542).

3. Alexander Graham Bell's only U.S. patent in 1878 was 201,488, which issued on 19 March. The French patent dated 12 February was 122,580.

4. Not found.

5. Edison's French electric pen patent was 112,719, dated 6 May 1876; his telephone patent was 121,687, dated 19 December 1877; and his phonograph patent was an addition to 121,687, dated 19 February 1878.

6. David Brandon handled most of Edison's French patents for several decades. See *TAEB* 3:513 n. 2.

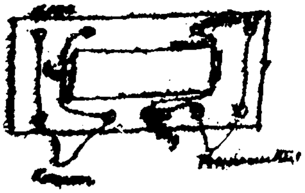
-1219-

Charles Batchelor to Edward Johnson

Menlo Park N.J. Feb. 26th 1878

Dear Sir

I send you 3[a] three coils, 3[a] three transmitters and 3[a] three receivers the coils are connected up like sketch with plug in transmi[tter][b] circuit to open your battery when you have to wait.[1]



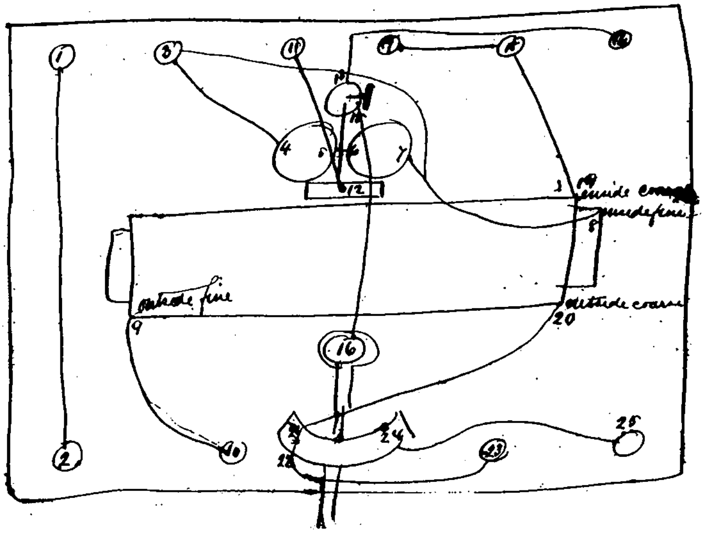
These coils are the best we have had, but last night we wound a coil that was at least five times louder and the articulation most perfect.[2] We find Bradley coils will not do as we must have better insulation [--][c] You would be surprised at our result after making one perfectly insulated. We are putting some of these coils now in hand and I shall send you two if Edison says so and you let me know where I can send them[3]

Batchelor

ALS (letterpress copy), NjWOE, Lbk. 1:356 (*TAEM* 28:224). [a]Circled. [b]Copy ran off edge of page. [c]Canceled.

1. Text is, left to right: (top) "Line" and "Battery," (center) "[Fine?]" and "[coarse?]," (bottom) "Receiver," "Plug," and "Transmitter." The following day, Batchelor drew a diagram that he labeled "New Coil box connections." However, this design probably did not work

properly as he gave another diagram to John Kruesi with the instruction to "make all connections hereafter like this You see there is no cross on these but in making these square connections on the other bases there may be." There are also two draft versions of the second design. Vol. 14:46–49, Lab. (*TAEM* 4:187–90).



The new coil box connection design of 27 February.

2. The laboratory staff had been experimenting with coil designs since the beginning of the month (Batchelor to S. Bergmann & Co., 7 Feb. 1878, Lbk. 1:337 [*TAEM* 28:210]). Records of these tests are incomplete, but notes of 10 and 20 February indicate that the best coil they had was one designated No. 12 with .6 ohms primary and 200 ohms secondary (Vol. 14:39, 43, Lab. [*TAEM* 4:180, 184]). On 28 February, Edison executed a patent application for a telephone call-signal which included a

> peculiar inductive coil, formed of a primary wire, forming part of a circuit in which is included a battery and a carbon telephone transmitting instrument. Around the primary wire is wound spirally but insulated from it a long length of fine wire which is included in the main line circuit, with the receivers, the coil, owing to the close proximity of the primary to the secondary, induces a very powerful current; an iron core somewhat increases this power, but decreases the clearness of articulation. [Pat. App. 203,017]

3. On 8 March, Johnson wrote Edison "I am a little shaky about the Induction Coils I have the sound was very low on the 26 miles I worked—& this time I've got to work 70. Hadn't you better let Bergman Bring in with him Monday 2 of your best— I will put them on my Boxes— I only want the coils." DF (*TAEM* 15:335).

-1220-

To Charles Fiske[1]

Menlo Park Feb 27, 1878

Dear Sir

Your letter of 25th receiv[ed.][2a] You ask if the Phonograph will record accur[ately][a] at the rate of 135 words per minute would sa[y][a] that it does and even faster. It is at present [too?][a] young for practical court~~re~~ reporting as you have to put your mouth within an inch or [two?][a] of the machine in order to get the vibrations [re]corded.[a] I will soon have it perfected to answer all the purposes you speak of for f~~o~~urther information I would refer you to Chas A. Cheever Tribune Building, N.Y. Respt Yours

T A Edison C[arman][3]

L (letterpress copy), NjWOE, Lbk. 1:375 (*TAEM* 28:239). Written by William Carman. [a]Edge of original not copied.

1. Unidentified.

2. Not found. Fiske was one of many who made inquiries as new reports about the phonograph began to spread. These correspondents asked Edison for information about the working of the machine and how they could either acquire one or obtain an agency for selling them (see "Edison, T. A.—Unsolicited Inquiries," 78-018, DF, NjWOE). Many of them also provided Edison with suggestions for possible improvements in the phonograph; see "Suggestions to Edison on Phonograph and Telephone" in Unbound Documents (1878), Batchelor (*TAEM* 92:294–89) and some of the letters in "Edison, T. A.—Advice," 78-004, DF, a sampling of which are in *TAEM* beginning on 16:596.

3. William Carman.

-1221-

From George Bliss

Chicago. Feb. 27th, 1878[a]

Dear Sir:

Charley[1] writes me from Port Huron and offers to work for me at the Paris exposition providing I will pay his expenses while he is at Paris.

As most of the visitors will be foreigners it will be necessary to have some one who can speak their languages.

It is barely possible if Charley can put up and explain the quadruplex and the other articles which you will exhibit that he can be used to advantage

Please let me know what you think of this. Charley says he is going to Menlo Park soon and I presume he will talk to you about this matter. Respectfully,

Geo. H. Bliss Gen. Man.

⟨G.HB= You neednt say it above a whisper but I do not think Charley would do—

I sent Louderback[2] Letter to Cheever with recco[mendation][3] Im going for Cheever for an agency for you⟩

ALS, NjWOE, DF (*TAEM* 17:555). Typed in upper case. Letterhead of Electric Pen and Duplicating Press Co., George Bliss, General Manager; letterhead and dateline are electric pen copy. [a]"Chicago" and "187" preprinted.

[1] Charles P. Edison (1860–1879), son of Edison's brother, William Pitt Edison.

[2] De Lancey Louderback (1849–1914), a former telegraph operator and manager, was at this time agent for Western Electric Manufacturing Co. in Philadelphia (*NCAB* 16:233). In another letter of this date, Bliss had written Edison that Louderback had "worked like a beaver for the [electric] pen this last year" and was interested in obtaining the phonograph agency for Philadelphia and the surrounding region (DF [*TAEM* 18:928]).

[3] William Carman wrote a letter almost identical to Edison's marginal note on 2 March in which this word was "recommendation" (Lbk. 1:392 [*TAEM* 28:254]). It probably refers to Bliss's other letter of 27 February (DF [*TAEM* 18:728]).

-1222-

From Asahel Eaton

Brooklyn, N.Y., Feb 27th 1878[a]

Dear Edison

The glass you inquire for would have to be made specially for you.[1] I do that kind of work and will undertake it for you if you wish. How many would you require.

Prof. Plympton[2] and three or four other professional gentlemen have expressed a wish to call upon you at Menlo Park, and see the wonders of the place. If you can name any time when you will be sufficiently at leisure, I will pilot them to your place Yours

A. K. Eaton

⟨I may require a 1000, but want 25 immediately. I use the disks which are 5/8[b] diameter & 3/100[b] thick ~~fo~~ In my Carbon telephone, for pressing down the platina disk on Carbon button by diaphragm Ivory wood Vulcanite etc swells or warps by ~~pas~~ heat due to passage of current through carbon How much per 100. or doz They must be flat. will name day when to bring your men over=⟩

ALS, NjWOE, DF (*TAEM* 19:635). Letterhead of A. K. Eaton, Chemist. [a]"Brooklyn, N.Y.," and "187" preprinted. [b]Written by William Carman.

[1] Two days earlier, Edison had written Eaton, "Do you know where can I get glass 3/100 thick and perfectly flat on surface I want to procure

discs of that thickness and about ⅝ diameter probably you know some one who would make them for us" (Lbk. 1:364 [*TAEM* 28:228]). On 6 March, Eaton replied that he could make the disks for $3.60 per dozen and for less than that by the hundred (DF [*TAEM* 19:647]).

2. Prof. George Plympton was a well-known civil engineer and professor of physics at Brooklyn Polytechnic Institute. Obituary, *New York Times*, 13 Sept. 1907, 7.

-1223-

From Norman Miller

Wednesday— [February 27, 1878][1]

Edison.

Mr O. called me yesterday morning, and asked "what I knew about" Adams going to Phila I told him that I was down to see you Monday, and you expected A. to go down Tuesday evening— He said that Merrihew[2] had full instructions, and that he had asked Bentley to give his personal aid and attention—[3]

In closing the conversation he as good as said that Your Tel. had got to do the "long and hard work of business lines—

I think he has great hopes of a good report from Phila

Miller

ALS, NjWOE, DF (*TAEM* 19:637).

[1] Doc. 1225 appears to be a response to Orton's inquiry; 27 February was a Wednesday.

[2] James Merrihew, who had been connected with telegraphy since 1849, was district superintendent in Philadelphia for Western Union's Southern Division. Reid 1886, 657; Western Union 1878.

[3] Bentley wrote Edison on 25 February that he had seen Orton two days previously and "he seemed very much interested in the proposed trial of your Carbon Telephone by me." Bentley asked Edison to make "this trial at as early a date as possible—if you have them so I can do so," as a report in the *New York Sun* concerning "your working to me in the midst of W.U. wires is exciting a great number of inquiries of me from many sections—I presume on account of its not being entirely believed" (DF [*TAEM* 19:632]). The *New York Sun* article is probably "A Marvelous Discovery," from 22 February, which quotes Edison, "I have whispered into [the telephone] here at Menlo Park, and been answered in a whisper by Henry Bentley in the Western Union office at Philadelphia" (Cat. 1240, item 378, Batchelor [*TAEM* 94:115]).

-1224-

From Edward Johnson

[c. February 27, 1878][1]

My Dr Edison

Everything conspires to curtail my Lecture business I yield to the pressure and have today indefinitely postponed the following

Providence R.I.	Bradford Pa.
Corning N.Y.	Richmond Ind.
Bath N.Y.	Cincin O.

And have agreed to give the following

Syracuse N.Y. 28th
Rochester N.Y. 12th
Buffalo N.Y. 13th[a]

The conspiracy is thus composed

1st Edisons aversion.

2nd Hubbards opinion that more harm is done—by premature Exhibition—than good—[2]

3rd My appointment as Generalissimo of the Phono Company[3] with full power to act & push things—& Especial advice to consult with you.

4h My Clockwork man made a miscalculation as to Power & produced a beautiful[b] Piece of mechanism "but it dont work"—hence I am compelled to go to Syracuse without it—but otherwise well equipped—

I of course dont pay him—& he has gone to work to make one twice as powerful & have it done by the 10th[4c]—thus giving me a 1st class outfit for Roch. & Bu. I want to give that one at Providence for Dr Channing[5] too. These Impt. & occassional Lectures I can easily find time to attend to without any special effort—It is clearly better for me to do it—than a Bell Telephone party— I return the checks as I have no immediate occasion to use them much obliged all the same Yours Truly

EHJ

Am glad to hear of the Improvement in the Telephone. You will be able to give me a pair of the Imprd Coils by Mch 10th Yrs

ALS, NjWOE, DF (*TAEM* 15:278). [a]Followed by horizontal line. [b]Interlined above. [c]Obscured overwritten characters.

1. This letter was written after Johnson received Charles Batchelor's letter of 26 February (Doc. 1219) regarding the improved telephone coils.

2. On 25 February, Cheever wrote Gardiner Hubbard and informed him

> I did speak to Johnson about the lecturing business, told him we did not think any more lectures better be given until we are ready to sell &c. He expressed himself as satisfied with my explanation & said "of course I will not exhibit any more for the present if that is your idea."
>
> I did not make it peremptory with him but put it in the shape of a suggestion and as that seemed to satisfy him thought I would not force it harder. Shall speak to him again about it tomorrow. [Box 1205, NjWAT]

3. Johnson was formally designated general agent of the as-yet unincorporated phonograph company a few days later (see Doc. 1238 n. 1).

4. This clockwork was made by Henry Loriot who delivered it by 12 March and billed it to Edison. Loriot was still trying to collect the $110 he charged for this clockwork as late as January 1880. Loriot to Johnson, 12 Mar. 1878; Loriot and Ostrom to TAE, 9 July, 8 Aug., and 12 Dec. 1879 and 15 Jan. 1880, all DF (*TAEM* 17:49; 51:680, 737; 52:90, 55:283).

5. William Channing was a medical doctor and inventor who had joined with telegraph inventor Moses Farmer to develop the first practical fire-alarm telegraph which was installed in Boston in 1852. At this time he was experimenting with telephones in Providence, R. I. *DAB*, s.v. "Channing, William Francis"; Prescott 1878c, 274–78; Prescott to TAE, 15 Feb. 1878 and Channing to TAE, 13 Mar. 1878, both DF (*TAEM* 15:241; 18:940).

-1225-

To William Orton

Menlo Park N.J. Feby 28. [1878]

Dear Sir

Mr Bentley has heard from me because I have written him three letters since monday. Mr Adams will go to Philadelphia tomorrow. The assignments were all delivered to Serrell today.[1] Mr Pope is over zealous about them Yours

T. A. Edison

ALS, DSI-NMAH, WUTAE.

1. It is not known which patent assignments were delivered, but on 9 February, Serrell had written Edison that "the Western Union Telegraph Company require certain assignments in connection with some of your applications" and asked Edison to come to his office as soon as convenient. DF (*TAEM* 18:628).

Patent Application: Telephony

New York, February 28, 1878[a]

1[b] To all whom it may concern.— Be it known that I, Thomas A. Edison, of Menlo Park in the County of Middlesex, and State of New Jersey, have invented an Improvement in Acoustic Telegraphs, (Case No 151,) of which the following is a specification:

2 The object of this invention is to transmit and receive oral communications over telegraphic wire by sound.

3 The invention relates to an arrangement of devices for transmitting two classes[c] of signals—one by the vibrations of the voice and the[c] other by a key or switch for signalling the distant station.

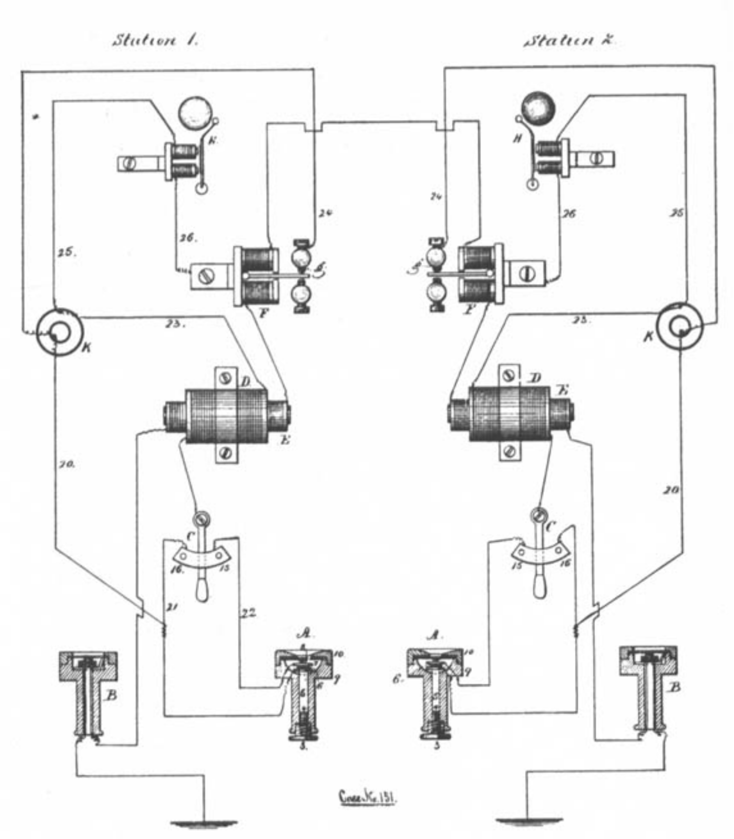
4 In my application No. 141 for[d] Letters Patent, filed July 20th, 1877,—[1] I have shown a carbon disk acted upon by the vibrations of a diaphragm to produce rise and fall of electric tension upon the line, such carbon disk being in the main-line circuit, and in my application No 146, filed Dec. 13th, 1877,—[2] I have shown a rheostatic device acted upon by the diaphragm to produce rise and fall of tension in the primary circuit of an induction coil.

5 I find that the carbon heretofore employed in connection with a diaphragm is not adapted to use in the primary circuit of an induction-coil, because its resistance is too great, and the necessary rise[c] and fall of tension is not produced.

6 If the carbon is mixed with other substances so as to separate the particles, the rise and fall of tension can be obtained, but its resistance is too great to be used in the primary circuit of an induction-coil.

7 I have discovered that lamp black obtained from the combustion of very light hydrocarbons, such as gasoline or naptha, can be used for the aforesaid purpose.

8 I select from lamp black thus made only the very blackest portions, and then place the same in a mould, and subject it to a very powerful pressure, sufficient to consolidate the same,[3] and place it in a correspondingly shaped cavity contiguous to the diaphragm, with a piece of cork or a piece of rubber intervening between the same and the diaphragm, and connect the disks of platina foil that are used at each side of the carbon in the primary circuit of the induction coil, and obtain from the pressure resulting from the motion of the diaphragm the necessary rise and fall of tension without the great resistance heretofore inseparable from the carbon in said circuit.



Inventor Thos A. Edison, per Lemuel W. Serrell atty.
Witnesses Chas H. Smith[4] Harold Serrell[5c]

9 I will now describe the action of the apparatus. A at station 1 is the carbon transmitter.[6] 9 is the body of the telephone. 10 is the cap for securing the diaphragm tightly. 8 is a piece of cork and rubber tube secured to the diaphragm. the rubber tube rests, when properly adjusted for speaking, against an ivory disk, 7.

10 The ivory disk rests upon a disk of platina foil, resting upon a button of Lamp black Carbon, 6; this, in its turn, rests upon the platinized surface of the rod 5, which is adjustable to and from the diaphragm by the right and left hand screws 3 and 4.

11 The platina on the top of the carbon disks next to the diaphragm is connected to a binding-post, and to the other binding-post a wire connects with the rod 5. Thus the circuit must first pass to the upper platina and through the carbon to the lower plate.

12 The vibrations of the diaphragm subject the cabrbon to different pressures, according to the amplitude of motion resulting from the sound-waves, and this difference of pressure varies the resistance offered by the carbon to the passage of the current, and produces a rise and fall of electric tension.

13 The instrument A. is included within the primary circuit of the induction-coil D.E. D is the primary wire of the coil, and is wound on the outside of the secondary coil E. C. is a switch which when moved to the right, in contact with 15, places the transmitter A in the primary circuit containing the battery K and coil D; when the switch is in the centre, the primary circuit is open and the apparatus is ready for the reception of a call-signal; when the switch is turned to the left, at 16, the instrument A is thrown out of circuit, and the battery only is connected to the primary coil D.

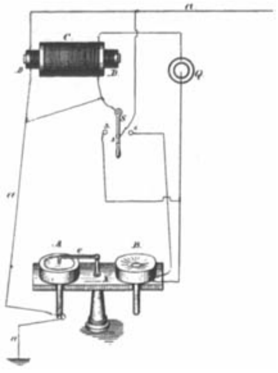
14 The movement of the switch from 16 several times serves to open and close the primary circuit and throw a powerful induced current into E and then to the line.

15 The polarized relay F, coil E, and receiving-instrument B are all placed in the main-line wire at both stations. The powerful current thrown into the secondary coil and line by the movement of the switch C from 16 works the tongues of both polarized relays F in unison with the switch; the tongues, closing against their contact-points, close a local ciercuit containing a call-bell, H.

16 The same battery K that is employed with the telephones is utilized to ring the bell. the connections for the transmitter A are from the battery K. by wire 20 to 21, then through the telephone A to wire 22, and from 22 to 15 through the switch-lever c to the primary coil D, and to wire 23 back to battery. This[c] is the connection for transmitting and receiving telephonically. when not thus working the switch C is placed in the central position between 15. and 16, when in this position, if the switch of the distant station is moved to operate the call, the tongue of F closes the local circuit at g. thence by wire 24 to battery K, and through K. to wire 25, thence through the magnets of the bell-call to wire 26, and then through the tongue of the polarized relay.

17 When the switch c is moved to work the distant call it is brought into contact with 16. and the current passes from K. by wire 20 to 16, thence through c. to the primary wire D, thence to 23, back to the battery K, and setting up a powerful induced current in the coil E and line.

18 I will mention that it is not necessary to use a polarized relay, as an unpolarized relay of the ordinary character may be used, as the current due to the opening of the primary circuit is much the strongest; but the lever of the unpolarized relay should be light and the spool very short, it is not even necessary to use the call-bell H in many instances when the terminal is very quiet, as the sound given by the polarized relay itself is sufficient; or a small bell may be worked by the tongue.[7]



Telephone circuit and bracket design from Edison's U.S. Patent 203,017.

19 The tongue of a polarized relay should be biased, so that it will always be away from the point g except when moved by the signalling currents, so as to prevent short circuiting the battery K. when transmitting telephonically.

20 By employing two cells and a considerable resistance in the magnets upon the call-bell it is not essential to bias the tongue, but it may be made to respond to both positive and negative, a shunt from one cell[c] being used to furnish current to the call-bell

I claim as my invention—

1st[f] The combination of transmitter A, coils D E, switch C, polarized relay F, bell H, battery K, and circuits arranged and operating substantially as herein set forth.—

2nd In combination with a telephonic and the[f] primary circuit of an induction-coil, the button of lamp black carbon prepared as set forth, and placed in the primary circuit, substantially as and for the purposes set forth.[8][g]

Signed by me this 28th day of February, AD 1878[9]

Thos A Edison

Witnesses, Harold Serrell Geo. T. Pinckney[10]

DS and PD, MdSuFR, RG-241, Pat. App. 203,016. Written by Harold Serrell; numerous alterations were apparently made to the document during the examination and publication process at the U.S. Patent Office; these have been ignored. Oath omitted. [a]Place taken from oath; date taken from text, form altered. [b]Section numbers written in margin in another hand. [c]Obscured overwritten letter. [d]"my application No. 141 for" interlined above; "No. 141" transposed from another line. [e]Signatures taken from printed drawing. [f]Interlined above. [g]"and . . . forth." interlined above.

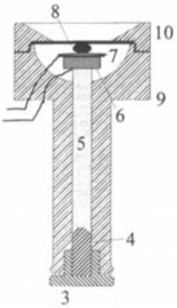
1. U.S. Pat. 474,231.
2. U.S. Pat. 203,013.
3. Prescott 1879 (pp. 530–33) discusses Edison's experiments with various carbon buttons, why he thought lampblack superior, and the process of preparing the carbon button. This section of Prescott is based on Edison's draft (Undated Notes and Drawings, Menlo Park Period, Lab. [*TAEM* 45:123]).

> The lampblack as it comes from the burning apparatus is laid upon a white slab and those portions that have a brownish tinge are picked from the pile. The remainder is ground in a mortar and then placed in a large mould & subjected to a pressure of several thousand pounds The cake thus pressed is repowdered & repressed several times, finally it is weighed out in lots of 300 milligrammes & moulded into buttons as seen in the telephone.

4. Charles Smith witnessed many documents in Lemuel Serrell's office.

5. Harold Serrell, Lemuel Serrell's son, was a clerk in Lemuel's office.

6. Here is a clearer version of transmitter A in the patent drawing.



7. The call-signal arrangement shown in this patent was for use on long lines. On the same day, Edison executed another patent application (U.S. Pat. 203,017) for use on short lines of one to twenty miles in length. In that design, the receiver was placed in a bracket with a lever extending over it and when a signal was sent from the other end of the line, the attraction of this lever by the receiver's electromagnet caused it to act like a telegraph sounder and signal the call. He also designed another call arrangement for use on moderate-length lines up to thirty miles long in which he used a telegraph sounder as a call signal (see Doc. 1240 n. 2). Edison described these and other call-signal arrangements in Prescott 1878c, 227–31.

8. This second claim was added before the application was sent to the Patent Office.

9. This application was filed on 7 March and issued as U.S. Patent 203,016 on 30 April 1878.

10. George Pinckney was a clerk in Serrell's office.

-1227-

Caveat: Phonograph

New York, N.Y., February 28th, 1878.[1a]

To all whom it may concern:

Be it known that I, Thomas A. Edison, of Menlo Park, in the county of Middlesex, and State of New Jersey, have invented an Improvement in Phonographs, of which the following is a specification:

The object of this invention is to record and reproduce from such records or a copy thereof, the human voice or other sounds.

The invention relates to the devices to accomplish this object, and I have set forth some of the details of the same and the incidental modifications employed or tested by me.

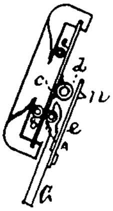
In my application, No. 149, filed December 24, 1877,[2] I have shown a cylinder rotated by hand and moving longitudinally at the same time by a screw.

The circumferential surface of the cylinder have a grooved spiral cut from end to end, having the same number of spirals per inch as the thread or screw on the shaft upon which the cylinder is secured, and on one side of the cylinder is a speaking tube, diaphragm and indenting point, immediately opposite the grooves on the cylinder. The movement of the diaphragm being recorded by indenting a material placed on the cylinder; on the opposite side is a similar apparatus provided with a diaphragm and point, also opposite the grooves which serves to produce the sound recorded by indentations. I have now dispensed with the extra apparatus employed for reproducing and now use the apparatus that records also for reproducing from its own records. After the record has been made the cylinder or plate is turned back to its original position and re-started when the indenting points riding in and out of the indentations originally made, set the diaphragm in motion and reproduce all the sounds. At the present moment I am not fully satisfied that using the same diaphragm, both for recording and reproducing, gives better articulation than when double instruments are used, it is certainly more simple. It is probable that a double instrument will have to be used to obtain loud reproductions.

The recording diaphragm being arranged with the spring containing the embossing or indenting point so that there is no lost motion between it and the diaphragm, the latter being a small and stiff diaphragm; on the other hand, the reproducing diaphragm is of very thin material, with a very elastic thin spring, such as the hair-spring of a watch, with a very fine point; by using a very delicate reproducing diaphragm and spring but little pressure is necessary against the indented material; hence, the point will not destroy the finer spaces between the indentations like the rigid system for recording.

It may be arranged so that one single spring can be used, both for indenting and reproducing, double diaphragms on one mouthpiece being arranged with a double lever to connect the spring with one or the other, at pleasure. I find that the smaller the diaphragm the better is the articulation; however, the amplitude is insufficient to give very prominent records, hence I use a moderately-sized diaphragm, dampening it on one or both sides as in Figure 1;[b]

Fig. 1.



e is the spring having an indenting point n; the spring is fastened to the upright arm, G; d is a rubber tube about one-fourth of an inch in length, connecting the spring with the diaphragm, c. It is fastened permanently.

A and B are also pieces of rubber tube placed on each side of the diaphragm and serve to dampen the diaphragm and prevent squeaking noises and improve the articulation by causing the diaphragm to return immediately to its normal position after each vibration— stiff springs, felting, water, mercury, air valve, magnetism, are among the means which may be employed for dampening the diaphragm. Even a rubber strip stretched tightly across the diaphragm on both sides may be used; a fiddle string may be also used on both sides provided with tightening screws to give it great tension that the diaphragm may be brought quickly to its normal position. It is not absolutely essential that a diaphragm for taking up the sound vibrations should be used, as strips as in Figs. 2, 3, and 4 and 5, may be used;

Fig. 2.

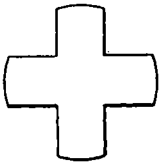


Fig. 3

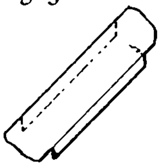


Fig. 4.

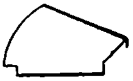
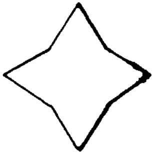


Fig. 5.



in fact, thin sheets of metal corrugated or having their edges turned over may be used in innumerable shapes; neither is it absolutely essential in recording or reproducing that the diaphragm should be in actual contact or be connected in any way to the spring e.

Fig. 6.

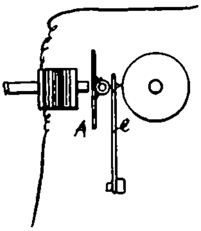
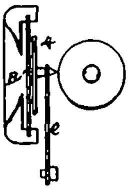


Fig. 7

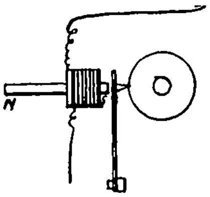


A small disc A, of mica or other stiff and light material is secured to the spring e, Figs. 6 and 7, which disc is immediately opposite the diaphragm B (Fig. 7), but not touching the air waves serving to give the requisite motion.

The disc may be iron and the diaphragm, or vice versa, polarized by a permanent magnet so that the motions are given to the spring through the medium of magnetic attraction and air as in Fig. 6.

The speaking and hearing diaphragm may be connected to the spring in various ways, such as a tightly-stretched thread, or telephonically by causing the spring which should be of steel magnetized, or of iron or capped with a disc of iron to be opposite a magneto telephone; its motion will give rise to induction currents in the magneto generator and these may be used in another telephone, as in Fig. 8.

Fig. 8.



When the carbon telephone is used, the spring is connected by a piece of rubber tubing to the two platina discs between which is the carbon all placed in a circuit containing a battery and receiver, as in Fig. 9. Of course, the line may be of any required length with complete apparatus at each end, the phonograph merely replacing the person talking.

Fig. 9.

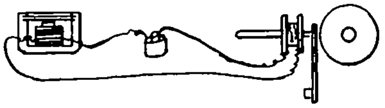
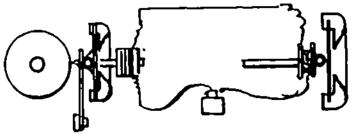


Fig. 10.



When it is desired to record speech from a distance, I arrange it as in Fig. 10; an electro-magnet in the line serves to give motion to the indenting spring directly or from a diaphragm.

When it is desired to collect speech several feet from the instrument, I arrange the diaphragm as in Figs. 11 and 12, a large chamber D, Fig. 11, being used to collect the sound; this it does with great power; several of them may be connected together; another plan is to use several chambers in different parts of the room and connecting by tubes to the recording diaphragm; still another plan is to connect several of my carbon telephones, Fig. 12, with the induction coils and batteries with these collectors and convey wires from each coil to a common magnet working the indenting point.

Fig. 11.

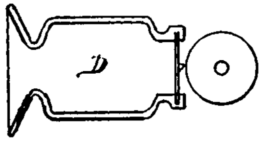
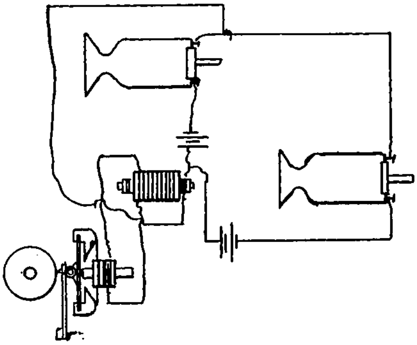


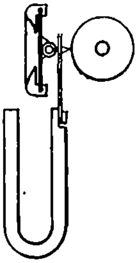
Fig. 12.



Another arrangement is to use but one coil and place it[s] secondary in connection with the magnet working the indenting point and all the carbon transmitters in one primary circuit of the coil with one battery. Many kinds of material may be used for diaphragm, such as mica, glass, porcelain, cork, rubber (soft and vulcanized), aluminum and other metals, parchment made impervious to moisture by a varnish, celluloid, guttapercha, sulphur, isinglass, gelatin paper cloth stiffened by varnishes and other materials, woods of various kinds, ivory, balato bone.

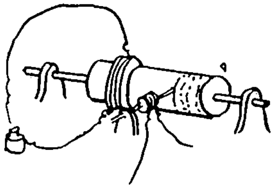
The material for recording upon may be various metallic foils or sheets, such as tin-foils of various compositions, iron, copper, brass, lead, tin, cadmium, zinc; also, paper and various other absorbent materials may be used and coated with paraffine and other hard hydrocarbons, waxes, gums, lacs, and these may be used to record on directly, or they may have a metallic surface; for instance, paper may be made to pass through a bath of hot paraffine, thence between scrapers; immediately after passing the scrapers thin metallic foil is placed on it from a continuous roll and again passed through rollers or scrapers, thus giving a beautiful surface and preventing the material from clogging the indenting point. The paper may be coated with gutta-percha or substances which become soft by heat, then in the act of indenting, it may be rendered plastic by heat, either by hot air or a lamp under the cylinder or plate. If thin iron-foil is employed, the indentation may be made in the usual way, but a novel plan may be adopted for reproducing the undulations of the diaphragm as illustrated in Fig. 13,

Fig. 13.



in which the spring-arm of the reproducing point connected to the diaphragm is highly magnetized, or the iron-foil may be magnetized, as in Fig. 14;

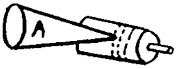
Fig. 14.



then when an indentation passes the point the attraction will be less than when no indentation passes; this will give good articulation, free from the scraping noise of the point on the foil, for in this case it does not touch the foil, but is worked by magnetic attraction.

If very thin foil is used with wide grooves in the cylinder, the indenting point may be dispensed with altogether and the indenting made directly by the force of the air-waves as in Fig. 15.

Fig. 15.



A is a funnel, ending with a very fine hole at the end of the funnel, almost in contact with the cylinder containing the foil. The force of the air-waves serves to force the foil inward between the edges of the grooves and thus record each vibration; these are reproduced by the disturbance of the air at the small end of the tube. A diaphragm closes the large end of A, thus creating a suction to raise the spaces between; the point may be even rounded and be in contact with the foil and produce the same effect.

The sheet to be recorded upon may be prepared with gelatine and bichromate of potash, and the diaphragm control a source of light, and thus record the vibrations, or the diaphragm may control a self-feeding pen, which deposits a fluid in more or less quantity, according to the amplitude of the diaphragm, and this fluid may combine with a material on the paper to make an insoluble compound, whereas the parts not touched with it may be washed away. Duplicate copies may be made with foils by using several together. The indenting point indents all at the same time.

The apparatus I propose to use for dictating letters is shown in Figs. 16, 17, 18, 19, 20.

Fig. 16

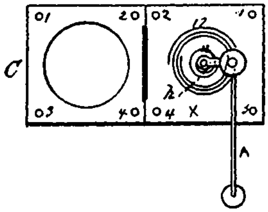


Fig. 17

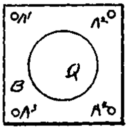


Fig. 18.

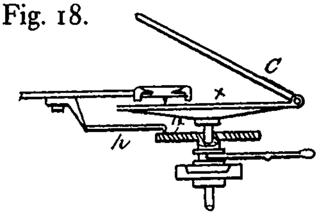


Fig. 19.

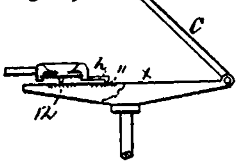


Fig. 20.

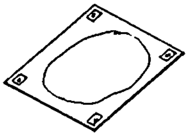
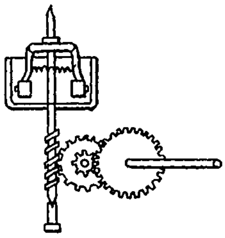


Fig. 21.



X, Figs. 16 and 19, is a plate revolved horizontally by a train of gear as shown in Fig. 21; this plate has two volute spirals cut from the center outward; the inner spiral 11, Fig. 16, is used for the purpose of carrying the arm A outward; this arm has upon its extremity the diaphragm and guide or carrying arm n;[3] the other spiral 12 is used to lay the foil or material to be indented upon; the point worked by the diaphragm is immediately over the grooves.

C is a frame hinged to X, and is used to secure the material to the plate X.

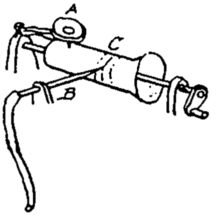
This frame is provided with 4 holes, 1, 2, 3 and 4, which, when closed on X, fit exactly over four pins 1, 2, 3 and 4, on X.

These pins are used to register the foil which is previously indented to go over the pins; the holes so punched in the record sheet I propose to eyelet. The sheet prepared for use is shown in Fig. 17. B is thick paper with a large hole in it equal to the size of the grooves in X; stretched over the frame work of paper is foil Q, with a small hole in the center. A^1, A^2, A^3, A^4, are holes punched to insure registration on the pins 1, 2, 3, 4 of X. It is not essential that the plate X should be square, it may be octagon or round; the spiral 11 may be dispensed with and cut underneath the plate, and the whole plate, two inches from the center, used for recording.

Even a separate plate on the same shaft may be used, this having the spirals for guiding the arm upon it, as in Fig. 18. A double spiral may be cut, one within the other, from near the center to the circumference of X, one being used to move the arm, the other to record in.

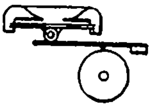
Even spirals may be dispensed with at 12, the guiding spiral alone being used, the foil being placed on a polished surface of glass, steel, or even a yielding material; the guiding spiral may be dispensed with and a worm used, connected to the driving gear, for giving a slow outward motion to the arm.

Fig. 22.



In Fig. 22 is shown a method of recording and reproducing the sounds on the principle of a sirene; A is a diaphragm which makes great amplitude; the grooves are so narrow and the point upon the diaphragm so sharp that the indentations are punched clear through the material. C is a cylinder, hollow, with a funnel-shaped face. B is an air tube connected to a source of compressed air or steam; it ends with a very small point immediately opposite the perforations; every time a perforation passes the hole it allows a puff of air to pass within C, and thus a sound is given. A flap may be used around the point of B to prevent leakage.

Fig. 23.



In Fig. 23 is shown a method of obtaining the advantage of leverage to indent a hard material.

Fig. 24

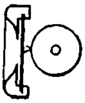
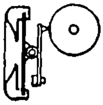


Fig. 25.



In Fig. 24 is shown the method of recording and reproducing by a point direct upon the diaphragm. Fig. 25 shows another arrangement to obtain the advantages of leverage. Fig. 26 shows a method whereby several persons may speak and have it recorded simultaneously.

Fig. 26.

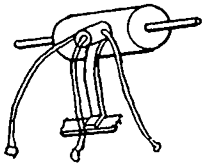


Fig. 27.

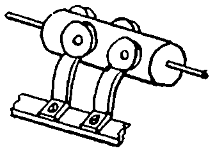
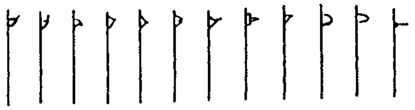


Fig. 27 shows another arrangement whereby several persons may speak simultaneously, but their record will be in separate spirals, the cylinders being provided with double thread or spirals.

Figs 28 29 30 31 32 33 34 35 36 37 38 83



Figs. 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38 and 83 show different indenting and reproducing points.

Fig. 39.

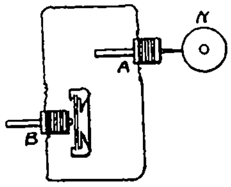


Fig. 39 shows a cylinder which has upon it iron-foil, indented by a separate mouthpiece. A is a permanent magnet close to the indentations; around the magnet is a coil of wire. B is a polarized receiving instrument. The rotation of N causes the indentations to throw inductive currents into B, and thus reproduce the speaking or other sounds; although the point of A does not touch N, the approach and recession of the iron causes the currents to be set up.

Fig. 40.

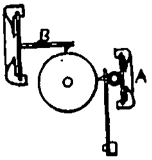


Fig. 40 shows both a recorder A, and a reproducer B A acts direct, while the lever of B cannot of itself indent the foil, yet falls into the indentations made by A.

Fig. 41.

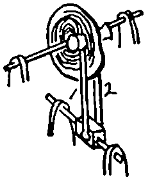


Fig. 41 shows a plate with spirals cut on each side with double reproducers, 1 and 2. This will be useful in toys, the sentence or sound being indented permanently on each side of the plate and the arms 1 and 2 being thrown in and out automatically.

Fig. 42 shows a reproducing apparatus for toys, etc., using a continuous indented band.

Fig. 42.

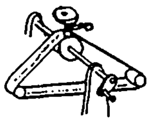


Fig. 43.

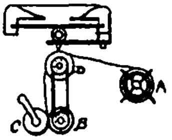


Fig. 43 shows a long strip or roll like that of a Morse register. A is a roll of the material, D the drum, B the reel upon which the material is wound, C, a roller which keeps the material smoothly on B.

A is rotated by friction and a belt from D.

Fig. 44

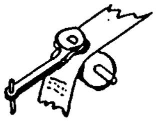


Fig. 44 shows a reciprocating lever and a continuous roll of material for recording and reproducing.

This system I am now engaged in perfecting.

Fig. 45.

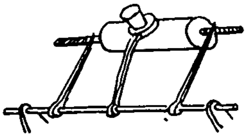


Fig. 45 shows an indenting and reproducing apparatus carried back and forward automatically by a double thread, one right hand on the front and left hand on the back of the machine.

Fig. 46.

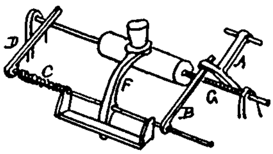


Fig. 46 shows an automatic machine suitable for advertising purposes: the arm F is carried forward by the screw G, in going forward it lifts up A, until A drops back, then the spiral spring, c, causes B to run over A, back to its starting point again.

D runs upon the smooth shaft, keeping F and its devices at a proper distance from the cylinder.

Fig. 47

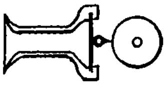


Fig. 47 shows a peculiar mouth-piece.

Fig. 48.

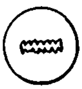


Fig. 49.

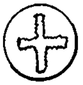
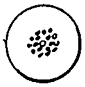


Fig. 50.



Figs. 48, 49, 50, 51 are mouth-pieces; the sharp edged holes are for the purpose of reinforcing the hissing consonants.

Fig. 51.

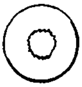


Fig. 52

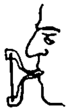


Fig. 52 shows a mouth-piece with the orifice of soft rubber and fitting in the mouth to the lips.

Fig. 53.

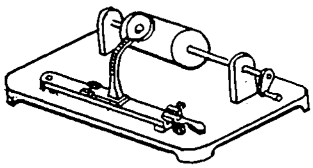


Fig. 53 shows the machine which I make for experimental illustration of the invention

Fig. 54.

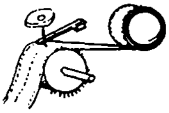


Fig. 54 shows a continuous roll of material with holes punched in each edge fitting over pins upon the drum to insure accurate registration of the ribbon.

Fig. 55.

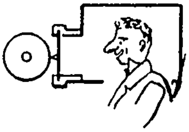


Fig. 55 shows a speaking box, where the whole head of the person speaking is confined.

Fig. 56.

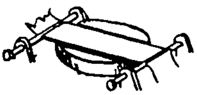


Fig. 56 shows a stretched sheet for insuring the reproduction and recording of high notes.

Fig. 57.

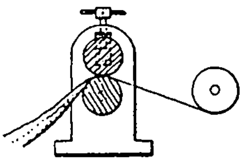


Fig. 57 shows a method of preparing bands of material already indented with the proper indentations for reproducing any kind of sounds, one roller having an original made by coating tin foil with copper and then steel, or making a plaster of paris mould from an original, then plating or casting from it and plating with steel or using soft iron and indenting, then placing it around a cylinder, backing it up with copper and case-hardening or carbonizing it so as to make it hard.

Fig. 58.

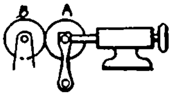


Fig. 58 shows a plan of using a wheel so prepared to knurl the indentations in by rotating A against a wheel B of soft material.

Fig. 59.

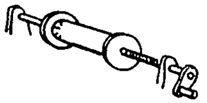


Fig. 60.

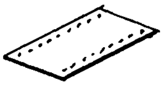


Fig. 59 shows a drum with sides and provided with pins for registering the sheet, as shown in Fig. 60.

Fig. 61.

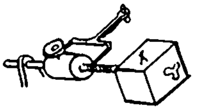


Fig. 61 is a toy apparatus; X, a clock-work rotating the cylinder continuously; an arm carrying the reproducing diaphragm is reciprocated by a double-threaded screw right and left on the shaft.

Fig. 62 shows almost the same thing; the double thread being on the drum.

Fig. 62.

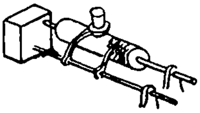


Fig. 63.

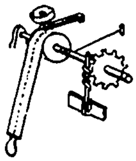


Fig. 63 shows a pull strip upon which the indentations are, pulling the strip downward, winds up a rubber elastic; when the strip is let go of the worm and fan regulates the power of the elastic.

Fig. 64.

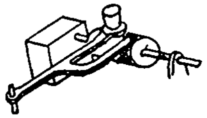


Fig. 65.

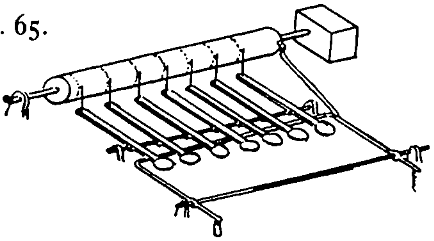


Fig. 64 is similar to 62. Fig. 65 is a cylinder and key board, around the cylinder opposite the keys are the necessary indentations to form a letter of the alphabet or a tone or note of the scale.

There are 26 keys for the alphabet, and for music several octaves.

The cylinder continuously rotates; the depression of any key causes the production of a musical note, or if for alphabets, the letter of the alphabet; it is very useful in the last instance to learn children the names of the letters.

Fig. 66 shows double indenting points and double thread or grooves on the cylinder,

Fig. 66.

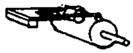


Fig. 67.

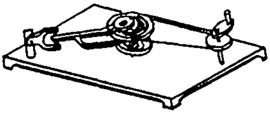


Fig. 67 shows a plate for recording upon, with plate underneath for guiding the speaking tube.

Fig. 68.

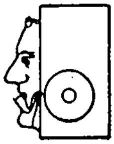
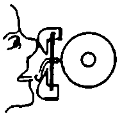


Fig. 69



Figs. 68 and 69 show a method of recording the movements of the lips and reproducing the same upon the same material as the talking is recorded.

Fig. 70 shows a raised screw on cylinder with a recording point like a W.

Fig. 70.

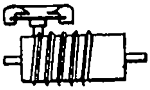


Fig. 71

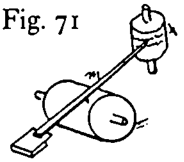


Fig. 71 shows a method of obtaining amplified records from the indented sheet. M is the lever, X a lamp-blacked cylinder; both are rotated slowly.

Fig. 72.

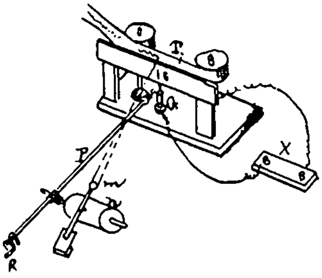


Fig. 72 shows a method of amplifying the records and photographing the same; n is the cylinder containing the indentations; m a small mirror; G a stand holding an electric or other light which passes through a slot 3 to the mirrors m, and is reflected back upon the paper T, which, with the cylinder N, is rotated by a shaft P, handles R, and worm at each end.

The paper T is photograph paper. X is the battery for giving the electric light.

Fig. 73.

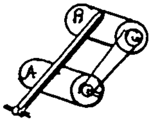


Fig. 73 is a plan for amplifying and reindenting.

This amplification is obtained by leverage. B is the cylinder containing the material to be reindented; it is rotated by a belt and pulley slightly faster than A, the extra movement of the lever B going faster gives longer and deeper indentations before the amplification takes place; the material on A should be stiffened by plating up it.

Fig. 74 shows double diaphragms.

Fig. 74.

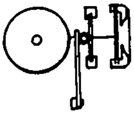


Fig. 75.

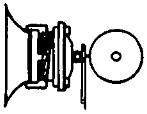
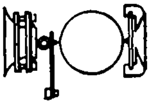


Fig. 76



Figs. 75 and 76 show stretched diaphragms.

Fig. 77 a double apparatus for recording and reproducing, the change from one to the other being made quickly by a lever.

Fig. 77.

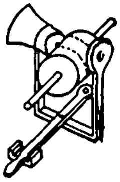


Fig. 78.

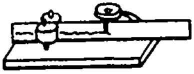


Fig. 78 shows a method of recording on smoked glass, for stereopticons.

Fig. 79

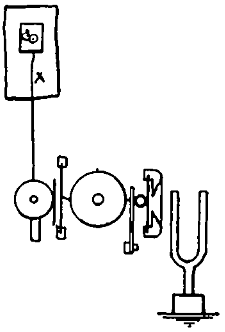


Fig. 79 a method of recording the sound, and[4] tuning-forks and obtaining their vibrating time, X being a pendulum to give the time.

Fig. 80.

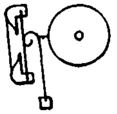


Fig. 81.

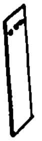


Fig. 80 shows a bent spring to replace the rubber tube usually employed.

Fig. 81 an indenting spring with three points.

Fig. 83.

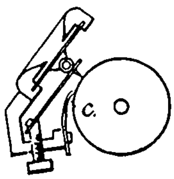


Fig. 83 shows an extra point c, for slightly grooving the foil before the indenting point; this takes part of the work off the indenting point.

I will mention that my latest experiments prove that it is not necessary that grooves should be used opposite the indenting point, as a cylinder or plate of polished metal, glass, or other material may be used and thick foil or sheet metal laid upon it to receive the indentation. Even the indentations may be made in solid cylinders or plates of metal, such as type metal, copper, iron (this may be case hardened). I propose to use ruby or agate indenting points; I will mention that I have succeeded in engraving the indentations in metal from looking at an amplified record, and have succeeded in producing musical notes by drilling numerous holes close together around cylinders; these may be made to work the reproducing point of the diaphragm and give a loud noise suitable for awakening persons, attached to a clock.

Fig. 82.

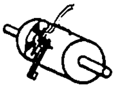


Fig. 82 shows a strip of paper secured at one end to the indenting diaphragm.

By drawing back the diaphragm and indenting point and bending the strip of paper, as shown by dotted lines in said Fig., so that the end of the strip is in the line of the indentations, the sounds recorded upon the foil will be reproduced by the same diaphragm that caused the sounds to be recorded.

Signed by me, this 28th day of February, 1878.

THOS. A. EDISON.

Witnesses: GEO. T. PINCKNEY. WILLIAM G. MOTT.[5]

PD (transcript) and D (copy), NjWOE, Lit., *American Graphophone Co. v. United States Phononograph Co.*, Edison Caveat of March 8th 1878, Defendant's Exhibits, p. 330 and PS, Caveat Drawings, Caveat No. 77 (*TAEM* 116:341, 8:890). Petition and oath omitted. The historic transcription was entered in evidence as an accurate reproduction, but many extant slips probably were not in the original text; obvious cases have been ignored or silently corrected. Inconsistent italicization of figure labels has not been reproduced. [a]Place and date from petition. [b]All figures are on four separate sheets.

1. Edison executed this caveat on 28 February. He filed it and a caveat on telephones, probably executed on the same day, at the Patent Office on 8 March (neither is in the existing National Archives file of Edison caveats; TAE to Painter, c. 8 Mar. 1878, UHP). Edison had essentially completed the designs in this document by 20 February, when he sent materials to Lemuel Serrell for preparation of the official copy (TAE to Serrell, 20 Feb. 1878, Lbk. 1:343 [*TAEM* 28:216]). Surviving sketches from 3, 4, and 8 February were clearly intended for this caveat (NS-78-007, Lab. [*TAEM* 7:862–70]; NS-78-007 (misidentified as NS-78-001), Supp. III [*TAEM* 162:552]). The three large sheets of drawings sent to Serrell on 20 February (Caveat Drawings, PS [*TAEM* 8:894–96]) contain only two sketches not repeated in the official caveat.

This was initially referred to as Edison's Caveat 77 (the telephone caveat of the same date was number 76). However, those numbers had already been used (Doc. 715 is Caveat 77). After the duplication was noticed this caveat became 77A.

2. Edison's U.S. Patent 200,521 had actually issued nine days before the execution of this caveat.

3. Should be "h."

4. Probably "of" in the original.

5. Unidentified.

-2- March–April 1878

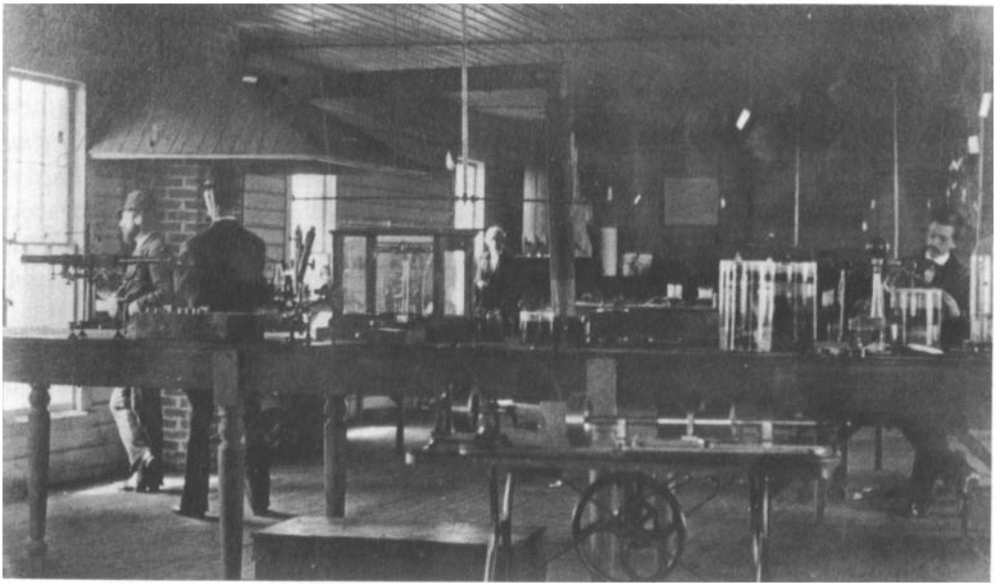
March began with Edison's attention focused on testing and modifying his carbon telephone transmitter. By mid-March, the tests he was making with Henry Bentley between Menlo Park and Philadelphia produced such a markedly improved design that Edison decided to send James Adams to introduce it in Europe. And he arranged with Bentley and Samuel Plush, superintendent of the Philadelphia Local Telegraph Company, to feature the new transmitter in a lecture given by Plush to the Franklin Institute on 20 March.[1]

The improved transmitter also intensified Western Union's negotiations with Edison, as well as Gardiner Hubbard's efforts to win him over to the Bell Telephone Company. The battle over telephone rights took on new urgency in late March when the Patent Office declared a series of interferences over telephone patents, including several between rival inventors associated with Western Union and Bell Telephone. In late April, just as Edison and William Orton agreed on the terms of a new contract with Western Union, Orton died suddenly at his home in New York. This not only delayed the agreement but left Edison without his strongest and most important supporter in the telegraph industry. On hearing the news of Orton's death, Edison is reported to have exclaimed, "If I get to love a man he dies right away. [Marshall] Lefferts went first, and now Orton's gone, too."[2]

While telephone developments had occupied much of Edison's time in early March, and negotiations with Western Union continued to require some of his attention, the early spring was taken up by new demands created by his growing fame as newspaper reports spread Edison's name across the country and through much of Europe. Reporters from the New York papers competed for exclusive interviews with Edison that were widely reprinted elsewhere. One of these reporters, William Croffut of the *New York Daily Graphic*, dubbed Edison with his famous nickname—"The Wizard of Menlo Park"—and also authored an April Fool's hoax about an Edison invention that could manufacture food out of air, water, and earth.[3] What became standard accounts of his early life also appeared at this time, most notably George Bliss's sketch in the *Chicago Tribune*.[4] By the end of March a constant stream of visitors was coming to Menlo Park to see the famous inventor and his phonograph, and in April he began to receive a steady flow of letters asking him for autographs and photographs, for advice, and for financial assistance.

The public interest in Edison derived in large part from the wonder that greeted the phonograph and he received scientific acclaim for this invention as well. Alfred Mayer wrote about his experiments with it for *Popular Science Monthly*,[5] and in Europe several scientific figures began to investigate the new invention following lectures and demonstrations by William Preece and Theodore Puskas. Joseph Henry, one of America's most renowned scientists, in his capacity as president of the National Academy of Sciences, invited Edison to exhibit his phonograph and telephone at the Academy's April meeting in Washington. While in the nation's capital Edison exhibited his inventions to President Hayes, members of Congress, and other government leaders. He also posed with his phonograph (and with Charles Batchelor and Uriah Painter) in the photographic studio of famed Civil War photographer Mathew Brady.

Members of the scientific community were among those giving public lectures on Edison's invention. Dr. J. W. S. Arnold, a New York physician and a professor at the University of the City of New York (later New York University) gave a benefit lecture on the "Voice and the Ear" for the New York Ear Dispensary which prominently featured Edison's phonograph as well as his telephone inventions. George Barker, physics professor at the University of Pennsylvania, also featured Edison's inventions in a highly successful lecture on the physics of sound that he gave at the Philadelphia Academy of Music. Also in Philadelphia, Samuel Plush included a demonstration of the small phonograph in his lecture at the Franklin Institute. In Paris, Theodore Puskas demonstrated the phonograph before France's prestigious Academy of Science.



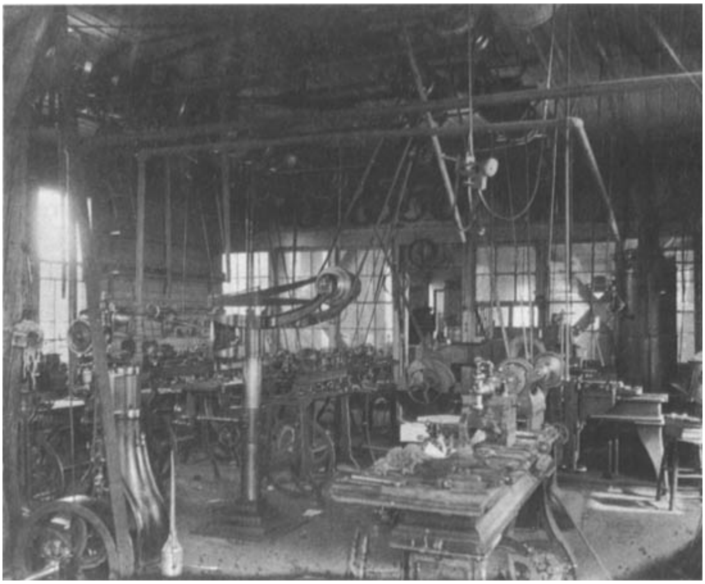
A view inside Edison's laboratory, on the upper floor at Menlo Park, taken about the end of March 1878 by S. A. Holmes, for the Daily Graphic's *use in making an engraving for a story in the April 10 issue.*

The success of these lectures, combined with that of exhibitions in New York, where several famous persons came to sing and talk into the phonograph, apparently convinced the directors of the newly incorporated Edison Speaking Phonograph Company to lease phonographs for exhibition rather than sell them. Edward Johnson, who was appointed the company's general agent at the beginning of March, soon ordered the production of exhibition machines. He also had Sigmund Bergmann manufacture twenty-five of the small phonographs, but these were considered unsatisfactory and the phonograph company sold only five. Meanwhile, the noted Paris instrument maker Edme Hardy began to manufacture small phonographs for Puskas to sell in connection with the Universal Exposition; Hardy's instruments were apparently more successful than the Bergmann machines. Puskas also concluded an agreement with the London Stereoscopic and Photographic Company for a licensing agreement to manufacture and sell phonographs in the United Kingdom.

Edison and Batchelor continued their experiments to produce a standard commercial phonograph. By the end of April, Edison had designed both disk and cylinder machines run by clockwork, which he included in his foreign patents and an American caveat. Though he built experimental machines based on these designs, he felt neither to be suitable for commercial introduction, though a clockwork cylinder based on his British patent was later manufactured and sold by London Stereoscopic, and Edme Hardy manufactured some in Paris as well.[6]

To assist with his experiments, Edison hired more machinists and other assistants in early March; by the end of the month he had "ten or twelve men at work in his factory—about 8 on the phonograph & the others on the Telephone."[7] The new workmen probably included machinists George Jackson, Thomas Logan, Albert Ekstrom, Charles Flammer, and John Hood, patternmaker Milo Andrus, and young laboratory assistant Alex Craig, Jr.[8]

One of the new lines of experiment that Edison began to pursue at this time was a heat measurer, soon to be known as the tasimeter, which was based on the same principle as his carbon transmitter—the variable resistance of carbon.[9] He even thought about using this principle in the design of an electric light. Edison's work on the phonograph also led to other spinoffs that he would pursue in the following months. Besides the aerophone, a loud-speaking device using compressed air which he had included in his original phonograph patent application, but which he subsequently patented independently, Edison also conceived a small motor, known as the phonomotor, that worked by sound and another device, known originally as the telephonoscope and later called the megaphone, for transmitting sound over large distances. In a



A view inside Edison's original machine shop, on the lower floor at Menlo Park, taken about the end of March 1878 by S. A. Holmes, for the Daily Graphic's *use in making an engraving for a story in the April 10 issue.*

newspaper interview he also discussed a hearing aid he had devised for his own use, which led to a large number of requests from the hard-of-hearing for him to develop a commercial design. Another "invention" that Edison mentioned in an interview was a medicinal preparation, which he called "polyform" and claimed would "stop any kind of pain immediately."[10]

Among the many visitors to Menlo Park was Henry Olcott, who had come to see Edison on behalf of Richard McCormick, the U.S. Commissioner to the Paris Universal Exposition, probably in connection with Edison's planned exhibition. Olcott, who had cofounded the Theosophical Society with Helena Blavatsky in New York City in 1875, found Edison interested in Blavatsky's ideas concerning occult forces. Blavatsky had mentioned Edison's etheric force experiments in her book *Isis Unveiled* and, as Olcott discovered, Edison himself had conducted experiments to detect occult forces in 1874. Although Edison joined the Society in April and Blavatsky expressed an interest in meeting him, Edison's participation in Theosophy was limited to waiving his royalty on a phonograph purchased by the Bombay branch in December.

Old alliances from his days as a telegraph inventor and manufacturer in Newark also drew Edison's attention in April. In that month he finally settled his suit against Atlantic and Pacific Telegraph Company for his salary as company electrician as well as a suit against the Domestic Telegraph Company, an Atlantic and Pacific subsidiary, brought by Edison with his manufacturing partner Joseph Murray. Edison had retained an interest in Murray's manufacturing shop in Newark and when their landlord, William Kirk, threatened to seize their machinery for back rent, Edison loaned Murray nearly $1,100. Nonetheless, Kirk was among the group of Newark's "first citizens" for whom Murray arranged a visit to Menlo Park at the beginning of May.

Little is known about Edison's home life during this period, but his busy schedule, as well as his propensity to work nights, probably left little time for family matters. Mary occupied part of her time by lending support to a Sunday school in Menlo Park.

1. Plush 1878.
2. "William Orton's Career," *New York World*, 23 Apr. 1878, 1.
3. "The Wizard of Menlo Park," *New York Daily Graphic*, 10 Apr. 1878, "A Food Creator," idem, 1 Apr. 1878, Cat. 1240, items 500, 470, Batchelor (*TAEM* 94:158, 150).

4. See App. 3.

5. Mayer 1878a.

6. Doc. 1310 n. 5.

7. "A Wonderful Machine That Will Be of Immense Value For Various Purposes," Cat. 1240, item 435, Batchelor (*TAEM* 94:131). In a 7 March letter, in the course of turning down an employment request from A. Debens, John Kruesi stated that two new workers had just been hired (Lbk. 1:414 (*TAEM* 28:276); see also Doc. 1264 n. 2 and employment correspondence in 78-012, DF [*TAEM* 17:453–65]).

8. George Jackson was hired in early March (see Doc. 1391 n. 10) and Alex Craig, Jr. was at the laboratory by early April (Craig to TAE, 13, 16, and 28 Mar. 1878, DF [*TAEM* 17:470–74, 476). Although Jehl 1937–41 (p. 680) claims that Thomas Logan was at the laboratory in 1877, there is no evidence of him before the first week of June 1878. The series of laboratory timesheets that begin in early June show that by that time Logan and all the others were working in Menlo Park.

9. See Doc. 1289 n. 3.

10. See Docs. 1210 n. 1, 1287 n. 3, 1298 n. 2, 1314 nn. 1–2, and 1326 n. 2.

-1228-

From E. C. Quinby

St. Louis, March 1st 1878[a]

Dear Sir

A friend sent me a "New York Sun"[1] wherein you are discribed as having invented several telegraphic[b] instruments, and Knowing I had tried to get some instrument that would[b] enable me to conduct the sound of voices to my brain through the teeth—marked[b] the article[c] My hearing is somewhat impaired, in the conducting aparatus, but I hear my watch[b] or any like sound as well through my teeth as I ever did

I thought I could use the telephone but have not been able to do it, & now write to see if you cannot help me out of my difuculties.

Hoping to hear from you soon I am Yours Respectfully

E C Quinby[2]

⟨Troubled same way my self have been told by several Profs that there was nothing matter with my ~~he~~Ear only wanting Cleaning out I hear distinctly through my teeth⟩[3][d]

ALS, NjWOE, DF (*TAEM* 15:4). Letterhead of Metal Mfg. Co. [a]"St. Louis," and "187" preprinted. [b]Obscured overwritten letters. [c]"marked the article" interlined above. [d]Written by William Carman.

1. Probably the article, "A Marvelous Discovery" in the 22 February *New York Sun*. Cat. 1240, item 378, Batchelor (*TAEM* 94:115).

2. According to the company letterhead, E. C. Quinby was president of the Metal Mfg. Co. They were manufacturers of "plain tin, stamped and japanned wire." The letterhead indicated that they planned to change their name to the Metal Stamping Co.

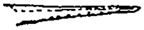
3. On 4 March, William Carman, acting as Edison's secretary, essentially repeated this marginal note in a letter to Quinby (Lbk. 1:406 [*TAEM* 28:268]). On 7 March, Quinby responded by again asking Edison if he had a device to "get the sound of a person's voice to my sense of hearing through the teeth." Edison did not respond and Quinby wrote again on 20 July to ask if Edison had such a device (DF [*TAEM* 15:7, 144]). On Edison's deafness see *TAEB* 1:7, 643, 656; 2:581, 786; 3:223, 230 n. 2, 399–400, 518, 623, 692–93.

-1229-

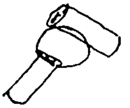
To Alfred Mayer

Menlo Park N.J. Mch 2= 78

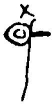
Friend Mayer=

Phonograph is now perfect. all that was required was[a] no 9 or 10 needle[1] flattened on top & bottom thus 

& made smooth with arkansas oil stone, & hair edge taken off= use the thickest size of foil sent you or next size to it[2] and dampen thus on speaking side only=



by proper stiffening of rubber tube X



and smooth needle you will get whispering perfectly and beautiful articulation even in hand turning—recognition of voice is easy=[3] Let me know how you succeed if not very well will send you spring & needle its nearly all in the manipulation of the needle point by the stone. Yours

T A Edison

ALS, NjP, Hyatt & Mayer. [a]Interlined above.

1. This refers to a number 9 or 10 sewing needle. "Edison Speaking Phonograph Instructions for Operating Experimental Apparatus," CR (*TAEM* 96:515).

2. On 19 February Charles Batchelor ordered tinfoil from J. J. Crooke, manufacturer of Crooke's compound tinfoil, indicating that he liked "the thickest the best." The following day Batchelor indicated in a technical note that tinfoil for the small phonograph was .002 inches thick. Batchelor to Crooke, Cat. 1238:258, Batchelor (*TAEM* 93:186); Vol. 14:43, Lab. (*TAEM* 4:184).

3. Around this time an editor of *Popular Science Monthly* wrote, "The voice, indeed, is somewhat muffled and minified when returned from

the iron tongue of the phonograph; but its intonations, inflections, pauses, and quality, are rendered with surprising fidelity." "The Edison Phonograph," 10 (1878): 748–49; this issue of the magazine was published by 21 March and contained material prepared as late as the beginning of the month.

-1230-

From John Dalton

New York March 2 [1878]

Dear Sir

When you mentioned the subject of your deafness yesterday,[1] I suggested your going for advice to the clinique of Dr Agnew, who is one of our most eminent oculists & aurists. Dr Agnew[2] tells me however that it will not be necessary for you to go to his public clinique, but that he would be happy to see you, on any day, at his office, No 19 East 39th Street, for that purpose— His office hours are from 9 A.M. to 1 P.M. It would be better, however, for you to go early than late, as his office patients are numerous and you will not have so long to wait. If you will send up a card with your name, he will recognize it and treat you accordingly— Yours very truly

J. C. Dalton[3]

⟨Carman Make a memo in book of address & office hours⟩[4]

ALS, NjWOE, DF (*TAEM* 15:5).

[1] Dalton and J. W. S. Arnold (see Doc. 1263) had visited Edison at Menlo Park the previous day. Dalton wanted both a large and a small phonograph and Edison sent him to Joseph Murray to see about having them made. Murray wrote to Edison about this on 2 March and again on 4 March, inquiring what price he should charge. On 4 March, Murray indicated that Dalton was "delighted" with Edison's phonographs and might "be the means of some out let for them as he wants to use them on Lecture tour to Elustrate sound." In April, Dalton purchased one of the first small phonographs manufactured by Sigmund Bergmann. Arnold to TAE, 2 Mar. 1878; Murray to TAE, 2 and 4 Mar. 1878; Edison Phonograph Co. royalty report for April 1878, all DF (*TAEM* 18:932; 19:46–48, 175.).

[2] Cornelius Agnew was professor of eye and ear diseases at College of Physicians and Surgeons in New York. *DAB*, s.v. "Agnew, Cornelius Rea."

[3] John Dalton was the first American physician to specialize in experimental physiology. *DAB*, s.v. "Dalton, John Call."

[4] It is not known if Edison went to see Agnew.

-1231-

From George Gouraud

London 2 Mar 1878[a]

My dear Edison

You dont say who is yr agent here if any for yr Telephone—If you have none I shall be glad to act for you—

In any case you should be on the ground at once—as now is the time—

I have from the highest authority that the P.O. here do not think Bells practical.

If yrs is what it appears there is ready money for you. Let me hear from you at once & if you like to place the matter in my hands send me full particulars

Sir Wm Thomson[1] told Mr Fleming[2] that he considers you "the very first Electrician of the Age"—

What a corner there would be in the "pie" market if your favorite diet were made publicly known![3]

~~Automatic~~Quadruplex[b]— Pray do what you can to bring about a compromise with Prescott—or depend upon it nothing will be got out of the Eng. P.O. for it by anybody. That may be taken for a fact & now is the time to strike there again—as you will see by S. F. & Cos letter to Reiff—[4]

Phonograph!— After this what may you not do.

I'll tell you one thing wh you can probably easily do—& and in wh there wd be money— Spring motor. Make a light machine for carrying one man on 3 or 4 wheels[c] propelled by a spring under the seat to be wound up in advance for as long a [——][d] journey as yr genius can manage If you could do this even for only a mile on a level road it wd be much—but if you can manage any ascent it will be better—Try it & you are sure to knock spots out of horses for short journeys Yours very truly

Geo. E Gouraud[5]

ALS, NjWOE, DF (*TAEM* 15:302). [a]"London" and "187" preprinted. [b]Interlined above. [c]"on 3 or 4 wheels" interlined above. [d]Canceled.

1. Sir William Thomson (later Lord Kelvin), professor of natural philosophy at Glasgow University, was among the world's premier contemporary physicists and electrical engineers. *DSB,* s.v. "Thomson, William."

2. Probably John Fleming of Smith, Fleming & Co.

3. This statement corroborates William Mallory's reminiscence that Edison's favorite meal consisted of apple dumplings (what Gouraud calls a pie) and coffee, which Edison told him was the first meal he ate after he arrived in New York in 1869 with little money in his pockets. Gouraud probably became aware of Edison's preference for this pastry when he and Edison ate at a French pastry shop in High Holborn Street

when the inventor was in London in 1873. Dyer and Martin 1910, 116–17, 150.

4. See Doc. 1210 n. 2.

5. George Gouraud had represented the Automatic Telegraph Co. in London. At this time he was resident director in Europe for the Mercantile Trust Co. See *TAEB* 1:280 n. 7.

-1232-

To Alfred Mayer

Menlo Park N.J. Mch 3= 78

Friend Mayer

Prescott is getting up a work on the Telephone and has asked me for all that I can give him.[1] I have about 4000 drawings,[2] and its too bad to give the results to such a charlatan. Couldnt you and Barnard[3] get up a small work on the Telephone; there is a demand answer= Yours

T A Edison

ALS, NjP, Hyatt & Mayer.

1. On the previous day, George Prescott had written Edison:

> I am going to publish a full account of the telephone, and want to give all the points in yours—of which the Scribner article is a mere sketch. Will you write out such an account of the improvements obtained by your method over all others as you wish to have published & also the particulars as to the manner of their production. Also inform me where your Musical telephone can be seen—I will send an artist to draw it. I want to make the telephone as complete in its description as the telegraph is. [DF (*TAEM* 17:19)]

Edison eventually supplied Prescott with his account which was published in Prescott 1878c, 218–34. Edison's draft is in DF (*TAEM* 17:180–96; 162:1047–49).

2. Several hundred pages of drawings related to Edison's work on telephony up to this time were entered as exhibits in the telephone interference proceedings of the Patent Office and more are in the surviving notebooks and technical notes at the Edison National Historic Site. However, an apparently extensive set of drawings kept in a notebook by James Adams disappeared upon his death. Edison Exhibits, TI 2 (*TAEM* 11:203–626); Vols. 10–15 and 18, NS-76-003, and NS-Undated-006, all Lab. (*TAEM* 3:813–1008; 4:1–193; 8:505–22).

3. Charles Barnard (1838–1920) edited the "World's Work" department of *Scribner's Monthly* from 1875 to 1884. Among his writings were articles on scientific and technical subjects (*NCAB* 13:64–65). He and Mayer had recently coauthored a volume on the science of light (see Doc. 1175 n. 2). On 7 March, Mayer declined Edison's suggestion that he and Barnard write a book on the telephone and instead suggested Brown Ayres as "a young man in the [Stevens] Institute," who was an experienced experimenter and "fully competent to write out the work" (DF [*TAEM* 18:938]).

-1233-

To William Orton

Menlo Park Mch 3rd 78

Dear Sir

You were partly correct, I did find a "bug" in my apparatus, but it was not in the telephone proper It was of the genus "callbellum" The insect appears to find conditions for its existence in all call apparatus of Telephones.[1] Another delay was the sickness of Adam's wife.[2] I intend to present you with a first class phonograph for your home, for reproducing music etc. this apparatus will run with a clockwork train. I will also place one in the room called "Experimental room" if you will be so kind as to inform me where that is.[3]

I wish you could find time some afternoon to come down and see my experimental room, (no desks manned with mathematicians) and hear some good phonographic singing and talking. Yours Truly

Thos A Edison

ALS, DSI-NMAH, WUTAE.

1. See Doc. 1226.
2. Ellen Adams.
3. The experimental room was connected with the electrician's office at the Western Union headquarters building. Israel 1992, 144.

-1234-

To Uriah Painter

Menlo Park NJ Mch 4 78

U.H.P.

I placed Aerophone model for patent in Serrells hands two weeks ago=[1] My god do you expect me to speak 48,000 words on a strip to send you it would take 4 hours;[2] I put 60 words at every revolution of the cylinder and can put 100 spirals per inch and the cylinder is 8 inches long figure it up[3]— Got the little phonos speaking as clear as the large ones; They are handy go for Johnson for one he is having 50 made=

Edison

ALS, PHi, UHP.

1. TAE to Lemuel Serrell, 20 Feb. 1878, Lbk. 1:343 (*TAEM* 28:216).
2. On 3 March, Painter had written Edison "send me piece of foil with 48 000 words on!" In response to Edison's statement, Painter replied on 5 March "I wanted to see if you realized how much 48,000 words were! I will be satisfied if you send me a piece at the rate of 48 000" (DF [*TAEM* 15:305, 313]). See Doc. 1277; Edison and Johnson 1878, 531, 534.
3. The instructions accompanying the commercial tinfoil phonograph (Doc. 1416) recommended an average rate of speed of sixty revo-

lutions per minute. That phonograph also had twenty-four grooves per inch, with a finer model having forty; Edison may have experimented with an even greater number. The eight-inch cylinder refers to the tinfoil recording surface, which was placed over the ten-inch mandrel of the phonograph. "Edison's Speaking Phonograph: Description and Instructions for Operating," CR (*TAEM* 96:510).

-1235-

From James Adams

Phil. March 4th 1878[1]

T. A. Edison

Telephones work O. K. Call Bells dont work with Callaud[2] worked a 220 Mile circuit all right Mr Bently sais you promised him one of the small Phonograph and their has been good many reporters here asking about it if you are going to send it down do so while I am here. if you have get a large one send it. Mr Bently wrote to Mr Orton about the saturday experiments which was red Hot[3] Induction on those wires not half as bad as New York. Send Phonograph to Mr Bently it will help us more than you think Prof. Barker was here to day and heard telephone on a 60 Mile [circuit?][a] wire Bentley speaks well of teleph[one][4a]

Receivers is not worth a god dam they are not strong enough Magnetized. every body is delighted with telephone[5] will you keep local on No 7. so I can get you any time.

P.S dont forget Phonograph J

Professor George Barker of the University of Pennsylvania.

AL, NjWOE, DF (*TAEM* 19:642). [a]Paper damaged.

[1] Adams wrote this on the back of a letter from Batchelor of the same date in which Batchelor indicated that he would "send two Instruments monday night (Mar 4) on brackets to test with new calls" (DF [*TAEM* 19:643]). Batchelor sent the brackets and a new receiver on 6 March (Doc. 1240).

[2] Developed by A. Callaud of France, the Callaud battery was a simplified version of a Daniell gravity battery (see *TAEM* 1:615 n. 3). King 1962a, 243, 245; Pope 1872, 106–7.

[3] On Saturday 2 March they made a test on a 30 mile loop to Wilmington and back to Philadelphia. Henry Bentley to George Prescott, 15 Oct. 1880, Box 1093, NjWAT; Bentley's testimony TI 1:318 (*TAEM* 11:136).

[4] George Barker was professor of physics at the University of Pennsylvania (see *TAEB* 2:328 n. 8). On 8 March he wrote to Edison that Bentley was "enthusiastic about your carbon telephone, which has surprised and delighted me also beyond measure" (DF [*TAEM* 15:333]).

[5] That is, the transmitter.

From George Bliss

Chicago March 5th. 1878[a]

Dear Sir:

Letter rec'd from Beetle of Feb. 16th & 17th.[1] It don't place matters in Europe in very favorable light thus far but seems to promise better for the future.

Story,[2] who is agent for Belgium and Holland is doing well and making good sales considering the extent of his territory.

The Austrian agents are Jews. They paid for their first bill of goods but for the second lot of about $1.000.00 are holding and Beetle expects to cancel their contract and give it to another party whom he thinks will be more energetic and make less trouble.

Germany is not yet started but Beetle expects to get it under way soon.

The sale to Switzerland of 30 is for future delivery and although the party is first class he has gone on a short trip and nothing will be done till his return.

The sale to Portugal is in about the same shape.

Beetle thinks he has a big prospect for a sale to Spain but you are such a lover of accomplished results that I wont mention it.

He also says an arrangement is about closed for Italy. We shall see.

The Baron[3] went back on Beetle in France and he has had to commence selling himself. The French manufacturer[4] has begun to deliver outfits—all sizes at $10.00 and he reports the goods as splendid. This makes a margin on future French sales and he says can do well in France hereafter.

There is a rumor flying round in the papers that the general use of the electric pen in Russia has been prohibited as the gov't controls the printing business.[5] Should this prove so there will be only one thing to do and that is to stock the gov't. I don't take much stock in the report as there are parties negotiating for the agency.

Beetle has gone into an extensive scheme of advertising the pen in France.

Herz has returned from Italy. He reports no prospects of making a sale of the quad. there. The gov't has an overstock of wires there. They are poor. They have the Stearns duplex[6] which is not used because not business enough.

They also claim to have the Meyers, or French quad.[7] Herz is going to Germany and Russia and says he is going to make a faifthful effort to sell the quad there. He expects to come back about April. Herz has secured the Gramme machine and Jablockhoff light for the U.S.

At a recent experiment in Paris one Gramme machine ran 16 lights for an several hours without a break of a second in any one of the lamps.[8]

One of the public squares of Paris was brilliantly illuminated and immense numbers of people took part the the public entertainment so Beetle writes.

Herz claims to have information from Preece that the negotiation in England for the quad is interrupted by Stearns who claims a slice?

Puskas has not turned up in Paris.

Beetle says Mr. Mignon[9b] who has been at the head of the Howe Sewing Machine Co. on the Continent is ready to push the phonograph, telephone and electric pen in Holland and in as much territory as can be allotted if placed in his hands soon.

If Puskas is to be detained in England long would it not be well to let this arrangement go ahead as quickly as it can be agreed upon all round.

The English Co. are pushing the pen in all the colonies. The sale of an English patent virtually means the surrender of an immense portion of the world. You ought to keep this fact in mind in your future sales of patents. Respectfully,

Geo. H. Bliss Gen. Man.

ALS, NjWOE, DF (*TAEM* 15:324). Typed in upper case. Letterhead of Electric Pen and Duplicating Press, George Bliss, General Manager; letterhead and dateline are electric pen copy. [a]"Chicago" and "1878" preprinted. [b]Obscured overstruck letter.

1. Not found.

2. Gustave Story, electric pen agent for Belgium and Holland, persistently sought an appointment as manager of the European business in place of George Beetle. In a letter to Bliss of 20 December 1878, Story denigrated Beetle's management and boasted, "I am certain that by myself alone I could in one year give greater publicity to the goods than all the agents united" (DF [*TAEM* 50:387]). An electric pen-pamphlet issued by Story is in Cat. 1032:131, Scraps. (*TAEM* 27: 921).

3. On 14 February, Bliss had written to Edison, "[Baron] D'Apremont being Gen'l agent for the pen in France is anxious to give it a good exhibit." Nothing futher is known about him. DF (*TAEM* 15: 237).

4. Edme Hardy was then manufacturing Edison's electric pen. See Doc. 1259.

5. The *Operator* of 1 March (p. 9) noted a report by M. Sergins Kern in the *Chemical News* that "the diffusion of Edison's electric pen is much

checked by Government regulations, as the use of printing implements for private study is strictly forbidden in Russia."

6. Joseph Stearns's duplex, the first practical method of mutliple telegraphy, had been adopted by Western Union in 1872 (see *TAEB* 1:101 n. 3, 521 n. 3). The Stearns duplex was not widely used in France as it proved undependable on Morse ink-recorder lines and inadequate for use with the Hughes printing telegraphs that were extensively employed on major lines (Butrica 1986, 112–13).

7. In the early 1870s, Bernard Meyer invented the first practical synchronous multiplex telegraph. Meyer's design used a distributor which allowed several instruments to share a single wire. It was first put into operation on the Paris-Lyon line in 1872 and subsequently used on other major French lines. Butrica 1986, 88–97.

8. This and the following paragraph probably refer to the lighting of the Place de l'Opéra with Jablockhoff candles driven by a Gramme dynamo. King 1962c, 404.

9. Unidentified.

-1237-

From Theodore Puskas

London 5th March 78.

My dear Edison,

I got lots of letters from you, many thanks for them.

This is only my first letter to you, but you must excuse me—I was awfully bothered with the English contract.—

Today I sent you 2 registered letters containing the Contract, the Agreement about the advance of fifteen hundred pounds and a Power of Attorney.—[1]

After what I cabled you first you will perhaps not think much of the Contract,—but under the circumstances I don't think that I could have made a better one.— About a fortnight ago,—that is when I cabled you first[2]—I had nearly settled everything with my parties—when they suddenly backed out,— because they were informed by competent people that your English patent was for several reasons a weak one.— In the first place it contains two distinct inventions which is always objectionable at least here in England—because people might infringe on the phonograph on the ground that one of your claims which relate to the telephone is a bad one.— Then to protect your phonograph you have ~~virtually~~ to fight for the telephone although[a] nobody might infringe on the telephone.— That is the reason why the parties would not consent to eventually pay more than one third of expenses[b] for legal proceedings against infringers.—[3]

Secondly you have some thirty claims;—the more claims you have in a patent here—the more they are afraid of such a patent.— If one claim will not hold good— the whole patent falls to the ground—till you disclaim.— Bessemer[4] looked through your final specification in the Patent Office—and told me afterwards that there were several claims which you could not uphold in an English Court.— Now he may perhaps be wrong, but his opinion about patent matters goes here a great way.—

Bessemer is also afraid that you have not enough of the Phonograph in your preliminary specification~~t~~— That is, that there is not enough in it—which will lead up to the phonograph of your final specification.— He says he would be very sorry if the court would declare your patent invalid on this ground.— ~~He ask~~ By the by he asked me to give you his compliments,—he thinks your Phono is a marvellous invention. It certainly is a pity that you have not a separate patent for the phonograph—but that cannot be remedied now—and we have to make the best of it.—

I should like with your consent to put your patent before the best counsel I can get here,—to have it carefully looked through—and to get an advise what parts have to be disclaimed.— I would then be able to send you the written opinion of the best barrister (in patent cases) Mr. Aston;—[5] the sooner you make ~~neece~~ necessary disclaimers—the better.—[c]

My letter is very confused, but perhaps you will be able to make something out of it.— I came today late back from the City[6] and am writing in great haste—because tomorrow morning I'll be off for Paris.— I have lost now time enough here in London—people are awfully slow here;— it took the lawyers nearly a fortnight to draw up the Contract.[c]

The Stereoscopic Co. is a very good firm.—[7] Rich—and [-][d] do a large business—sell a great deal in retail.— Their principal store is in Regent Street—have the best customers of London.[8]

Nottage is Alderman & Sheriff of London—[9] his influence will help us in litigations.—[c]

If you don't think it too much—will you give me one third of your interest in the English Contract?—[10]

That will leave you 33⅓ percent of the profits—or at least a minimum royalty of respectively: 16⅔—13⅓ and 10 percent of the selling price.—

If that is agreeable to you,—then[c] please pay to Serrel out of my 500 pounds—the 200 dollars (or there about) which I owe him,—further the costs for patents in all[c] the remaining countries which you mentioned in one of your letters[11]—and send me the remainder to Paris care of Col. Beetle.[c]

The agents of the Union Bank in New York are (I think) Kuntre Brothers.—[12][c]

I will look after your interests here in England.—

As soon as I get notice of the arrival of small phono I will come back from Paris and show the same to Nottage whereupon he will order by cable through you a few hundred.—[c]

Please send me also as soon as possible a plate instrument so that I might give orders for the Exhibition.—

Send also clocks.— Nottage wants to give orders for them too.

I have a great deal more to write—but I am too tired today.

Will write you soon from Paris Yours truly

Theo. Puskas

Preece got his phono[13] We are now waiting for the Telephones.—

ALS, NjWOE, DF (*TAEM* 15:316). Letterhead of Theodore Puskas. [a]"al" interlined above. [b]"of expenses" interlined above. [c]Followed by centered "— . —". [d]Canceled. [e]Interlined above.

1. The contract was a licensing agreement for manufacture and sale of phonographs in the United Kingdom by a British firm, the London Stereoscopic and Photographic Co. (see note 7). The agreement specified Edison's royalty as half of the net profits on the sale of all phonographs "toys clocks figures and all instruments of all kinds" involving his patented invention. A supplemental agreement provided for a £1,500 non-refundable advance on the royalties anticipated from the contract (both agreements, dated 22 March, are in Miller [*TAEM* 28:1080, 1086]). On 7 March, George Nottage, manager of the British company, indicated that he was sending the papers to Edison (DF [*TAEM* 19:215]). The power of attorney sent by Puskas is unsigned (Miller [*TAEM* 28:1177), but an agreement of 16 April between Edison and Puskas did include a power of attorney for Puskas regarding these matters (TP).

2. Puskas is probably referring to his cable of 8 February (see Doc. 1196 n. 5).

3. The 22 March contract specified that the company was not bound to participate in any infringement proceedings, but that if it elected to do so it would be responsible for one-third of the cost. Miller (*TAEM* 28:1080).

4. Henry Bessemer (knighted the following year) was a very prominent and wealthy inventor, engineer, and industrialist (then retired), known primarily for developing the process and equipment for manufacturing steel identified with his name; he had had extensive and expensive experience with issues of patent rights. *DNB*, s.v. "Bessemer, Sir Henry;" McHugh 1980, ch. 9 & 11 passim.

5. See Doc. 1554.

6. The City of London was a politically separate administrative territory of about one square mile in the midst of metropolitan London, containing the major financial, legal, and press institutions and business headquarters of England and the British Empire.

7. The London Stereoscopic and Photographic Co. advertised itself on its letterhead as a prize-winning portrait photography establishment and official photographers for several international expositions as well as for the Prince and Princess of Wales. The firm was a partnership of George Swan Nottage and Howard John Kennard (of whom nothing further is known), with Nottage managing. According to Nottage, bringing out scientific novelties was also their specialty. Nottage to TAE, 7 Mar. 1878, DF (*TAEM* 19:215).

8. Located in the western part of central London, Regent Street was (and remains) among the more fashionable and expensive of commercial addresses. The company's headquarters, however, was in the City of London, at 54 Cheapside. Agreement with Edison, 22 Mar. 1878, Miller (*TAEM* 28:1080).

9. That is, of the City of London, not of the whole metropolis. On or before 18 February, Nottage sent a cable to Edison, but Edison could not at first establish who "Sheriff Nottage" was. James James to TAE, 18 Feb. 1878, DF (*TAEM* 15:248); see also Doc. 1248.

10. Edison's and Puskas's 16 April 1878 agreement formalized this division (TP).

11. In response to Puskas's cable of 2 March (see Doc. 1208 n. 7), Edison wrote to Serrell on 5 March "concerning further foreign patents" on the phonograph and Serrell advised him that "it will be best for you to look over the drawings and spec[ification]s as we have them, leave out any unnecessary matter, and add any improvements." He also asked Edison to call at his office to discuss the "best way of proceeding." Serrell to TAE, 6 Mar. 1878, DF (*TAEM* 18:634).

12. The advance from the London Stereoscopic and Photographic Co. was put in the hands of this London bank; their New York agents (of whom nothing further is known) were to let Edison have the funds once he presented the signed contract. Contrary to Puskas's understanding here, George Nottage's letter to Edison of 7 March indicated that the transaction in New York would be handled by the Bank of New York. DF (*TAEM* 19:215).

13. See Doc. 1204. Apparently this phonograph did not arrive in time to be used in Preece's lecture and demonstration at the 27 February meeting of the Society of Telegraph Engineers, as the machine brought by Puskas was the only American-made phonograph shown there (see Doc. 1249 n. 2).

-1238-

Edward Johnson to Uriah Painter

NYork 3/5/78

Dr U.H.

Have seen Hubbard & made things O.K.[1] I am to help run things at HdQrs till the machines are ready for the mkt. then go ahead with my lecture business If we find my services are not imperatively demanded at home. I am also to have the sale of machines on commission when out in the lecture field. I began my career today under favorable circumstances—making a little improvement on the Phonograph which increases the sound so enormously that it is now twice as loud without a funnel as anything heretofore produced with a funnel— Kiralfy[2] who was at Menlo Park yesterday says its far ahead of Edisons— I've got the Bell folks wild they were disposed to contest with me[a] in the matter of getting from their machine better & louder talking than I from mine—but they gave it up today & owned up that I knew it better than they My room is No 28,[3] address all letters to me there. Cheever opened both ~~yo~~those you sent to his care—he said "in mistake"— He & I will get along all right— I begin to see through him already— I learned him in 5 minutes talk with He & Hubbard His weakness is, to be considered fertile in Ideas— I gave him some—which in talking to Hubbard he gave as his own— I've nailed him Ill keep him supplied with them & allow[a] him to appropriate them—getting my compensation in some direction of more moment. I am to get 50 machines out at once— R Hoe & Co[4] will probably make the first lot. Hubbard has given me to understand that he considers it all important to get control of that Toy License[5] I told him I thought I could do it & after a final talk on it He has left it entirely in my hands & says he will agree to pay them a royalty of 10% for their franchi[se][b] Now I want to do this if I can in order to make me solid with them— Give me some Idea how best to go to work. I'll give you my "leverages"—

1st. Moody[6] & Russell Have done nothing so far—but look for money—which they have not—& as yet have failed to get.

2nd. James[7]—who got them this license from Edison is impecunious to the last degree—& has importuned me to work with him in getting some other parties licenses from the Phono Co. He will be equally ready for a small bonus to join me in getting the Toy license back into the Phono Co's hands—

3rd— I think Edison will join the effort as he will receive his 10% still—and will have a more[a] certain guarantee of getting his $6000. beside he will feel that in our hands toys will begin to appear, while in the present hands there is but limited prospect. It is not agreeable to him to have his Ideas locked up till by degrees other people think of them and appropriate them.

On the other hand there is against me

1st the undoubted fact that they know & fully appreciate the value of their license

2n They are in more or less harmony with Davis[8] of the Clock Co—who I understand has made them some overtures It will be to his interest to sustain the Toy license as against a monopoly.

3rd Any effort to approach them will of itself raise a point to overcome.

Give us some of your worldly wisdom—

What, if anything have you done about Blairs appointment[a] and what if anything additional have you from Robinson—[a] Make him tell you why it is impossible—get him to make the explanation he hints at Let me, in brief—know the other side of the story— I will go to Orton in this matter—so soon as I know both sides— He will try to accommodate me I think[9] Yours Truly

E. H. Johnson

ALS, PHi, UHP. [a]Obscured overwritten letters. [b]Letters written off right margin.

1. On 3 March, Painter wrote Edison: "I had Johnson come over here to see Hubbard yestdy— I have got them to agree to make him manager of the Phono' Co'— Then you & I can know it is all going on OK. & can keep it within our control— What do you think of it?" DF (*TAEM* 15:308).

2. Imre Kiralfy, a Budapest-born actor and theatrical impresario, had just returned from Paris where he had "made a Number of important arrangements for American Inventions" and on 24 February asked to meet with Edison to discuss similar arrangements for his inventions. Kiralfy came out to Menlo Park on 1 March, where, according to Charles Batchelor's diary, he spent the entire day. On 16 March, Charles Cheever wrote Gardiner Hubbard that Kiralfy, whom he identified as "pretty well known in New York as a party who gets out theatrical novelties for exhibition in the various parts of the country," had applied for the "exclusive right to use the Phonograph for the exhibition of concerts." Although he thought Kiralfy "about as enterprising a chap as there is going in the business," Cheever felt that it would be "injudicious for us to tie ourselves up by giving him exclusive right for all concert purposes." Obituary, *New York Times*, 29 Apr. 1919, 15; Kiralfy to TAE, 24 Feb. 1878, DF (*TAEM* 19:839); Cat. 1233:60, Batchelor (*TAEM* 90:83); Cheever to Hubbard, 16 Mar. 1878, Box 1205, NjWAT.

In a *New York Sun* interview of 29 April, Edison reported that Kiralfy had visited him the previous week and

> was in ecstasies over the phonograph. He wants me to make him forty or fifty large cylinders, which he proposes to take to Paris. After securing the finest musical performers, each one will be invited to play into different diaphgrams, and the notes are to be re-

> corded by the cylinders. The greatest prima donnas, tenors, contraltos, and bassos are to sing, and their words and melody transcribed by the phonograph. ["The Inventor of the Age," Cat. 1240, item 561, Batchelor (*TAEM* 94:186)]

In May and June Kiralfy also sought to exhibit Edison's musical telephone in a series of European concerts; Edison was to receive ten per cent of the gross receipts. On 11 June, Edison gave Kiralfy a six-month option on such exhibitions but nothing appears to have come of this. Kiralfy to TAE, 29 May, and 4, 5, and 8 June, 1878, DF (*TAEM* 19:854, 858–860); TAE to Kiralfy, 11 June 1878, Lbk. 3:264 (*TAEM* 28:713).

3. After his signature, Johnson gave his address as "Room 28 Tribune Bldg NY."

4. Robert Hoe & Co., founded in 1822, primarily manufactured printing presses, most notably its famous rotary presses. The company also did repair work, manufactured other items, such as a circular saw, and did contract work for others. Lubar 1987, 259–65.

5. See Doc. 1168 n. 7.

6. Joseph Moody had apparently become Oliver Russell's partner in the toy contract. He was associated with the Lykens Valley Railroad & Coal Co. in New York. William B. Hollingshead deposition, p. 3, *American Graphophone v. Leeds & Catlin,* Equity No. 8,570, Circuit Court of the U.S., Southern District of New York.

7. James James.

8. Henry Davies.

9. Nothing is known regarding this matter or about Blair, but see *TAEB* 3:452. Robinson may be Heber Robinson, manager of the Philadelphia Western Union. "The Philadelphia New W.U. Office," *Operator,* 1 July 1876, 7; Reid 1879, 178.

-1239-

From Henry Bentley

Phila 3/6/78

Friend Edison:

I was going to suggest the very changes you are making—at least 3 of them.[1] We have not had success with your Receivers for there was really scarcely any permanent mag[netism] in them. We soon saw the trouble. But we look on that as of little importance as it is easily remedied. It seems to me as if there was no limit to this thing. I want to get the things now coming from you and then I am going to bring the news paper men in. Of course to make up for the loss of power in the small induction coil I will put on more cells for a long test. With the arrangement as I want it I will let you know when to go over to Drexels in N.Y. and have a test on his wire[2] this week one day. When I think of the limited scope of the Magneto, this Carbon telephone stuns me.

I want the Phonograph here and then I will have a newspaper gathering.[3] Also I am going to help Prof— Barker out in his Lecture at Academy Music[4] April 15 Adams is doing A.1.

H Bentley

ALS, NjWOE, DF (*TAEM* 19:645). Letterhead of Philadelphia Local Telegraph Co.

1. Edison's letter to Bentley describing these changes has not been found. Changes in Edison's telephones from around this time are indicated by Docs. 1222, 1240, and 1241 and include a glass disk and a steel spring to compress the carbon in the transmitter, a new mouthpiece design, and changes in the call signal. Edison and his staff also experimented with the type and number of battery cells and with induction coils. Other possible modifications of the transmitter design are shown in drawings of 22 February, 1 and 6 March, and of the receiver in drawings of 6 March (Vol. 14:45, 51–55, Lab. [*TAEM* 4:186, 192–96]).

2. This was a private telegraph line between Drexel & Co. in Philadelphia and Drexel, Morgan & Co. in New York. The latter company, founded in 1871, brought together in New York the London-based Morgan and Philadelphia-based Drexel banking houses. Carosso 1987, 136–74.

3. According to the 9 March *Philadelphia Inquirer* ("Phonograph and Telephone Experiments," p. 2), Bentley exhibited the Edison phonograph and the carbon telephone transmitter at a private gathering on 8 March. Probably reflecting Bentley's view, the article called the carbon button "a more important if not more wonderful invention" than the phonograph and noted that Bentley demonstrated the telephone over a seven hundred and fifty mile line from Philadelphia to Pittsburgh via Baltimore. According to Bentley's later testimony in the Telephone Intereferences, the Philadelphia Local Telegraph Co. logbook of 8 March recorded a "test with Edison's phonograph and carbon telephones to Baltimore via Pittsburgh, failure." Bentley stated that "the Baltimore operator telegraphed that he failed to hear us" (TI 1:318–19 [*TAEM* 11:136]).

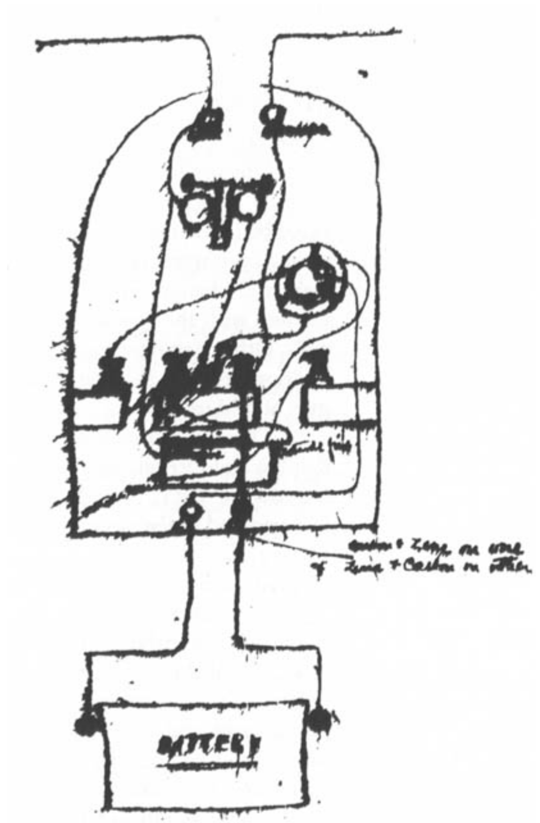
4. The American Academy of Music on Broad St. in Philadelphia, which opened on 26 January 1857, was at this time the largest opera house in the United States (Blodget and Freedley 1885, 16–17). On 8 March, Barker wrote Edison about his lecture and asked for suggestions of "good things for me to do, and to ask of you the loan of the large phonograph and of some of your carbon telephones." He indicated that Orton had "cheerfully" agreed to the use of Western Union wires for demonstrating the telephone at the lecture and that Bentley "promised to give me talk on the stage with Chicago direct." Barker hoped that Edison himself would "find time to come on to the lecture & stay with me" (DF [*TAEM* 15:333]).

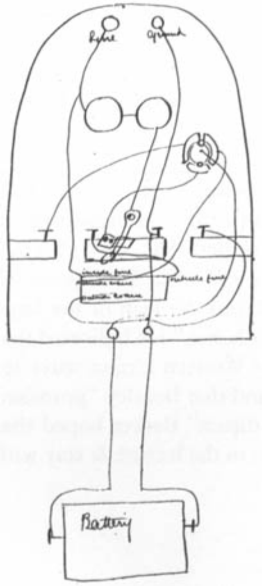
-1240-

Charles Batchelor to James Adams

Menlo Park N.J. March 6th 1878

Jim,





Charles Batchelor's 1 March 1878 drawing of the new telephone bracket.

We send you two brackets[1] today connected up like sketch[2] they have Bunnell sounders[3] on for calls and a plug arrangement for switch. When you talk and receive put plug in top when you call put plug in bottom hole— with the bindposts at bottom which go to battery you must put on one bracket line to left, for the other line to right so that you have then when you call the effect of both batteries and use 3 callaud cells on each end Remember that these arrangements are not for more than 300 ohms although you can use telephones with as much resistance as you like but more than that is not good for calls. I send you a receiver that will beat the ones you have and I will send you two transmitters and another soon the transmitters being better for mouth Keep using them all time and find out all about their lines and also any defects that may be in instruments Yours—

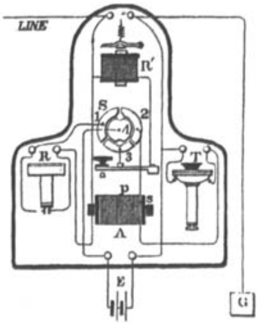
Chas Batchelor

P. S. I told Ellen when you wrote I had heard from you B[a]

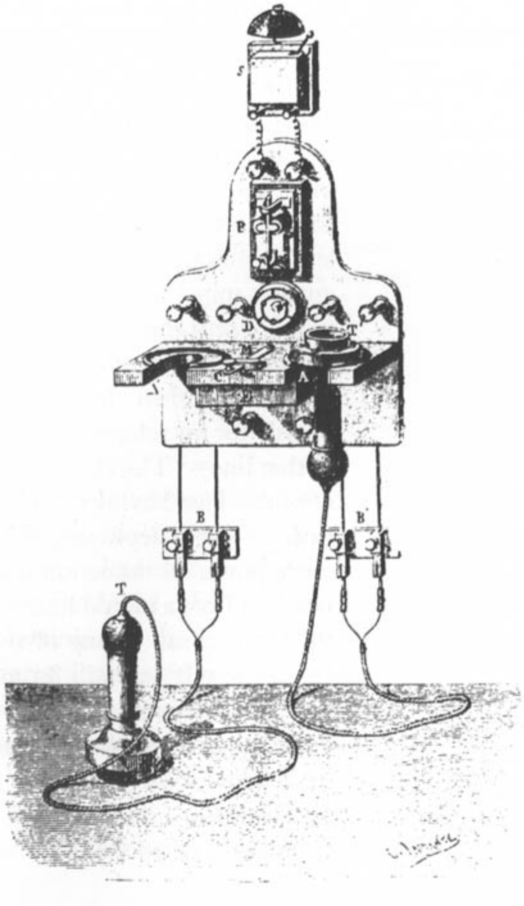
ALS (letterpress copy), NjWOE, Lbk. 1:411 (*TAEM* 28:273). [a]Followed by centered horizontal line.

1. Figure labels are: "LINE," "GROUND," "inside coarse," "inside fine," "outside fine," "outside coarse," and "BATTERY"; the first four are very badly smeared. The entire figure is degraded from ink bleed in the letterpress copy paper.

2. Batchelor's sketch is the same as his 1 March drawing except for the text at lower right, "carbon & zinc on one & zinc & carbon on other." The 1 March drawing is the first evidence of this design. On 7 March a local circuit was added for the sounder, and on 18 March the plug was moved to the center of the board (Vol. 14:50, 56, Lab. [*TAEM* 4:191, 198–99]). It is unclear from these drawings whether the instrument at the top of the board is a sounder or a relay for a local circuit that operates a sounder that is not shown. Edison described this arrangement in Prescott 1878c (pp. 228–29) as best for "lines of moderate lengths, say from one to thirty miles," and a drawing of 12 March shows it on a line with way stations (Vol. 14:60, Lab. [*TAEM* 4:202]). The drawing in Prescott shows the sounder **R′**, plug switch S, receiver **R**, transmitter **T**, primary induction coil **PA**, secondary induction coil s, and battery **E**. The unlabeled key should have been K and is shown under the switch. Edison described its operation as follows.



This circuit diagram for the telephone unit from George Prescott's 1878 book on the telephone shows the plug moved to the center.



An arrangement of Edison's telephone used in demonstrations in France and England during 1878.

> When a plug is inserted between 3 and 4, the relay or sounder R′, battery E, and key K only are included in the main line circuit, and this is the normal arrangment of the apparatus for signalling purposes. The battery, usually about three cells of the Daniell form, serves also both for a local and main battery. When a plug is inserted between 1, 2 and 4, the apparatus is available for telephonic communication.

A telephone unit of this design was illustrated in Prof. William Barrett's article on the carbon telephone in the 21 November issue of *Nature* (Barrett 1878d; see also DuMoncel 1974, 198).

3. This refers to sounders manufactured by Jesse Bunnell, possibly one of two he devised himself. He received a patent for one of these on 16 February 1875 (U.S. Pat. 159,894). The other was known as the giant sounder. According to an advertisement in the *Operator* (15 Aug. 1875, 2), he applied for patent protection for this device, but no patent seems to have been granted. In a 23 March letter to electrical manufacturer Henry Thau, Charles Batchelor indicated that the Bunnell sounders Edison was using were half-size (Lbk. 1:460 [*TAEM* 28:310]).

-1241-

To Henry Bentley

Menlo Park N.J. Mch 7 1878—

Friend Bentley.

I think the steel spring on the diaphragm of the Transmitter is a large improvement in the constancy of adjument the rubber flattens after a time and thus renders a new adjustment nec'esy I do not know why I did not try this before as I have often thought of it The fact is friend B that I have received so little encouragement before your test except from Mr. O. and so much opposition from the Scientific (sic) dept that it got my mind in a condition not active in matters Telephoniqué. I sent this pm a small phono and t~~r~~elephone transmitter with a more universal mouthpeice,[1] also a receiver with more magnetism. Im getting up a new gravity battery expressly for my telephone that will I think go ahead of anything in that line=[2] The shelves sent you were made in a hurry and of pine I am having 6 made of light mahogany polished with rims to hold telephones=[3] I am also experimenting to get a more powerful induction coil, etc=[4] I think $20 per station would if I got a mould for rubber made cover all expenses and this is as cheap as any of them= I will be on hand for the Drexel test If you will let me know= when= You know its rather a noisy route and we may have to use 3 cells local I find that with 20 ohm Bunnell Sounders it makes a fine call on 5 miles with .3. Watson gravity cells at each end, which are thrown in the line when telephones not working and on telephones when call bells not working= I think bells are a nuisance= ~~o~~On a longer wire. small relays like those in the repeating case at G and Stock could be used and these would work to 25 or 30 miles with the 3 cells and a longer distance on 4 cells= a sounder or small bell could be used being supplied from the same cells. Yours

Thos. A. Edison

P.S. I will send your tests to the Society Tel Engineers London[5]

ALS, MiDbEI, EP&RI.

1. What Edison meant by the "universal mouthpiece" is unknown. It may be the cupped design shown in "'Bentley's Exhibit' Edison's Carbon Telephone March 25th 1878" (TI 2:535 [*TAEM* 11:662]); cf. "'Bentley's Exhibit' Edison's Carbon Telephone No. 1," (TI 2:534 [*TAEM* 11:662]) and Prescott 1878a, 854. This cupped design is also shown in a Charles Batchelor drawing of 22 March; however, the telephone based on that drawing was finished with a different mouthpiece (see headnote p. 173, n. 3; NS-78-011, Lab. [*TAEM* 7:918]; "'Bentley's Exhibit' Edison's Carbon Telephone No. 4," TI 2:537 [*TAEM* 11:665]).

2. See Doc. 1269 (fig. 15).

3. These were for the Paris Universal Exposition. Charles Batchelor to Henry Thau, 23 Mar. 1878, Lbk. 1:460 (*TAEM* 28:310).

4. Laboratory records of induction coil experiments are incomplete. Regarding earlier induction coil experiments see Doc. 1219 n. 2. Notes of 14 March record tests with six different coil designs, each using different wire gauges and resistances; "Coil No. 5" became the standard coil (see Doc. 1355). Vol. 14:59, 64–68, Lab. (*TAEM* 4:201; 207–11).

5. The Society of Telegraph Engineers was founded in London in 1871 and later became the Insitution of Electrical Engineers. Edison and Batchelor were both members. Edison sent Bentley's report (Doc. 1247) to William Preece, who was also a member, but no mention was made of the report in the Society's journal.

-1242-

To Alfred Mayer

Menlo Mch 7—78

Friend Mayer.

My man will make you two or three points and send by mail.[1] =the dished diaphragm does not appear to work well either on the telephone or the phonograph, but I think iron is the wrong material Im going to try it by making a number of fiddle strings like the spokes of a wheel running from a hub and secured to tension regulators pasting or sewing a[a] thin parchment diaphragm over all and make the indenting spring pull the centre outward funnel or dish shape=[2] I find that very elastic rubber is all that is required for dampening= I see you have your hands full ~~with you~~ of work—[3] I think the new clockwork phonograph with the aid of a good smart boy will materially assist you~~r~~ in getting through your work— you can dictate enough in 10 minutes to keep him going about 2 hours; Would you be so kind as to ask Mr Ayres[4] to come down and talk the Telephone matter over= Those little corked needles you sent are immense.[5] I got experimenting with them and like a man eating peanuts couldnt stop. Their movements are certainly curious, and I believe this idea can be worked up into a useful test instrument— Ive rigged up a jar already with one in for telling which is N. or .S in my telephones and the men used it today several times. They are Magnetic Vidcoqs—[6] Couldnt I ascertain the power of a magnet by placing one in a dish of thick glycerine and take the time it consumes in travelling across the dish to a magnet on the other side, or would the difference in the magnetic fields of long and short magnets be a source of error— Mem—a double point on spring of phono one behind the other gives double sounds and is nice in singing— Im going to get some diamond—rub~~b~~y and amythist points made[7]—will supply you— = I will call on .R[8] and see what he can do for my big ears; Yours, Truly

Thos. A. Edison

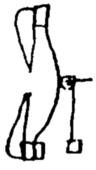
P.S. Prof Rood[9] ought take a run out here if he can=

Tests of my Carbon Telephone at phila shows that it works 720 miles, on regular WU line,[10] and also[a] talks down[a] completely ~~over~~ 4 Bell instruments in [-----][b] a short[c] line with men shouting in them=

ALS, NjP, Hyatt & Mayer. [a]Interlined above. [b]Canceled. [c]"a short" interlined above.

1. In a letter of 6 March, Mayer thanked Edison for devoting a day to showing him experiments during a recent visit and, among other topics, asked for another point and spring for his phonograph as his initial one had been worn almost totally away. DF (*TAEM* 18:935).

2. Mayer had asked about the dished diaphragm in his 6 March letter (see note 1) and on 14 March he suggested another way to create a "membrane dished like the drumskin of the ear" (DF [*TAEM* 18:942]). On 29 May, Edison wrote Clarence Blake about a



> dished diaphragm of postal card, when it is dished it requires no dampers, but if flat it may be dished by light dampers with same results= Of course the voice is more human and it will record the lowest tones perfecly but the loud talking makes it squeak. [CJB]

See also figure 21 in Doc. 1341, which shows a concave diaphragm.

3. In a 7 March letter Mayer told Edison that in addition to his academic duties he had "given my word to 3 publishers to write 10 books for them within three years." DF (*TAEM* 18:938).

4. Brown Ayres was a student at the Stevens Institute in 1878. He had visited Menlo Park with Mayer and Henry Morton in January, and Mayer had suggested that he rather than Mayer write a book on Edison's telephone researches (Doc. 1232 n. 3; Ayres to TAE, 20 Jan. 1878, DF [*TAEM* 15:187]). On 9 March, Ayres asked Edison to name a day when he could come out to the laboratory to confer on the book, but nothing further came of this and Edison's account was published in Prescott 1878c (DF [*TAEM* 17:21]; see Doc. 1232 n. 1). Ayres went on to study with Henry Rowland at Johns Hopkins University before becoming professor of physics and electrical engineering at Tulane University. He later became president of Tulane (*DAB,* s.v. "Ayres, Brown").

On 30 March, Ayres submitted an article on the theory of "The Telephone" to the *Journal of the Franklin Institute,* which was published in the June issue (Ayres 1878). Primarily a mathematical analysis of telephone technology, it briefly described Edison's carbon telephone. Ayres also discussed experiments in which telephone conversations were carried on "between different floors of the same building, using the gas and water pipes as conductors" and suggested that there was a "close analogy between these telephonic currents" and Edison's etheric force. This led him to suggest using a telephone as a "delicate electroscope" for detecting rapidly oscillating currents.

5. In his 6 March letter (see note 1), Mayer had enclosed "a dozen of magnetized needles" (each stuck the same distance into the center of a cork with the N pole up) and suggested that Edison "Put two, then 3, then 4, then 5, & so on in a basin of water and bring down over them a rather large cylindrical bar magnet— The experiments will explain themselves. They will greatly amuse you & they are very suggestive." See also Doc. 1175 n. 4.

6. François Eugène Vidocq was a legendary French police officer and adventurer of the early 1800s who became the quintessential detective in European and American popular fiction and culture for the rest of the century. Edwards 1977.

7. On a letter from John Holland, a Cincinnati pen manufacturer who wrote regarding the use of iridium and diamond points for the phonograph, Edison instructed his secretary to "Write and say that I have both a saphire and Diamond point both of which work well but are rather expensive. say that I have never tried Iridium and if he would be so kind as to send a small piece I would try it and send him a record with results." On 10 April, Holland sent a piece of brass wire tipped with iridium in the manner used in his best "Gold Pens." DF (*TAEM* 18:974, 980).

8. In his 6 March letter (see note 1), Mayer supplied the address and office hours of Dr. Daniel Roosa, indicating that he was "the best aurist in N.Y." and "a particular friend of mine." Roosa, who was on the faculty of the University of the City of New York, had been present when Mayer lectured on the phonograph before the New York Ophthamological Society two weeks earlier. *DAB,* s.v. "Roosa, Daniel Bennett St. John."

9. In a postscript to his letter of 6 March (see note 1), Mayer had written that his friend Ogden Rood, professor of physics at Columbia College, wanted one of the long cylinder phonographs for the college

and was willing to pay as much as sixty dollars. *DAB*, s.v. "Rood, Ogden Nicholas."

10. See Doc. 1239 n. 3.

-1243-

To William Orton

Menlo Park N.J. March 7= 78

Dear Sir=

You will notice in the contract that all improvements on the phonograph ~~which~~ that[a] connect it with Telegraphy which may be made by me within the next 17 year~~s~~ are reserved.[1]

As the phono stands it has no connection with a telegraph and requires a connecting link. this link is reserved.

Again, there is a clause which compels them to make no discrimination between any corporation or individual in the matter of price, when the machines are for the use of such individual or corporation.

Hence should I within the period of my contract with the W.U.[2] devise the connecting link it would come under the contract and the WU could purchase the phono proper at the same price as others=[3]

₽ I put it in this form as the safest. Do you not think this accomplishes the object Yours Truly

Thos A Edison

ALS, CSt, Linke Collection. [a]Interlined above.

1. Edison was responding to Orton's letter of the previous day, which stated that he had read Edison's phonograph contract (Doc. 1190) and found that it "contains no reservation for the W.U. Co. particularly—nor telegraph business generally." Orton also asked to see Edison and try his new telephone, noting that "Bentley speaks of it with increasing favor." LBO 21:32–33.

2. See Doc. 876.

3. On 19 March, Uriah Painter wrote Gardiner Hubbard:

> I saw Mr Orton to-day & told him I had secured the ap't of "Phonograph ag[en]t for Johnson & that we would have some machines on the market in few days. He said he considered it one of the most curious things he had ever seen but he did not see how it was going to be brought into practical use— I told him it was a good thing to build on. That we were going to put it into a stock Co & I could get him some of the stock. He said he did not know about it, he would see about after a while— I dont believe he will put up a cent on it at present. [Box 1205, NjWAT]

-1244-

From George Bliss

Chicago March 8th, 1878[a]

Friend Edison,

Here I am in a pretty shape. Ashley writes me that my article before the Chi. Electrical Society is a romance and all that I have ever heard about you isn't so.[1] I am reduced to the necessity of going to New York to write an accurate history of your life in self defence.[2] It is so hard to live now days I can't spare time for such recreation but what must be done can't be helped.

I telegraphed you today in Louderbacks behalf.[3] He is red hot on the phonograph question. Hope you will do what you can for him. It looks as if I should not be able to reach N.Y. till last of next week.

Wheeler writes that the fast press is still on the stilts. I shall stay at Menlo till finished so if you don't want a permanent boarder hurry it up. Gray says you gave Bailey a letter to Puskas but did not say you intended to join teams on the telephone.[4] How is it? Beetle writes that Roosevelt has withdrawn the suit at Paris begun against the parties selling the German telephones. They find a Frenchman has an old patent which endangers[b] the Bell patents. Beetle's information on such matters is not always reliable. He says the German telephones are sold at $3.00 in Paris and the Bell at $6.00. Respectfully,[c]

Geo. H. Bliss Gen. Man.

LS, NjWOE, DF (*TAEM* 15:330). Typed in upper case. Letterhead of Electric Pen and Duplicating Press, George Bliss, General Manager; letterhead and dateline are electric pen copy. [a]"Chicago" and "1878" preprinted. [b]Mistyped as "endagers." [c]Mistyped as "Respectfull."

1. See Doc. 1213 n. 3.
2. See App. 3.
3. In this telegram, misdated 27 February in *TAEM-G1*, Bliss told Edison that Louderback was "crazy to be agent for the Phonograph give him a helping hand." DF (*TAEM* 18:929); see also Doc. 1221 n. 2.
4. See Doc. 1271.

-1245-

From Uriah Painter

WASHINGTON, D.C. MAR 8 1878[a]

Dr Sir—

Yours without date to hand—[1]

If you can send me down a working aerophone it will be a good leverage— Will I have to wait for "EHJ" to make a Phono before we get you or one over here? J likes his new position. He has now a first class chance to show what there is in him— They like him so far, & if he makes it a success we can get plenty money at sight for new things—

I find that Toy concern have done nothing! Have failed to get a cent to manufacture or try any experiments— Will you help us to get it? so we can put on wheels— We wont let 3 months pass idly by as they have! Yrs

U H Painter

ALS, NjWOE, DF (*TAEM* 15:337). [a]Date and place from *Philadelphia Inquirer* hand stamp.

1. Not found.

-1246-

Edward Johnson to Uriah Painter

New York Mch 8th 1878[a]

My Dr U.H.

All right I'll go for James— Clock Co got nothing out yet but hard at it. Its no fool of a problem but it will be done. The Toy problem is the simplest as it does not require that the talking shall be perfect. Baby's dont talk when they are born.

I can't send you my Phono. because I start for Rochester with it monday night.[1] Shall get back Friday. My clock work will probably be done on monday. I'll ask Edison to send you one of the little ones.

Hoe is too slow. He wants 10 Days to Estimate on it. So I took the bull by the horns & closed a contract today with a smaller–but good–concern to make 25. Deliverable in a fortnight— More perfect than Edisons model $10. Each— they will be saleable—[2]

I am seriously thinking of making 25 of the Large ones— They can be sold for 75 or 80 $ at once to colleges alone–with written guarantee not to use outside—Talk to Hubbard about it. Edison advises it.[3] I have orders for 2 or 3 now— The small ones will not suffice where power is used These[b] professors have[b] power & want them for illustrating the Laws of sound. The Law permits them to make & use them I am told—They will have them made Elsewhere if we dont make them. Wm Cullen Bryant "gone" on the Phono. Entirely.[4]

See Mrs Hubbard[5] & tell her she is booked for the 1st new machine Yours Truly

E. H. Johnson

Edisons Tel. on trial in Pha— worked OK to Pittsburg & back 700 miles different routes

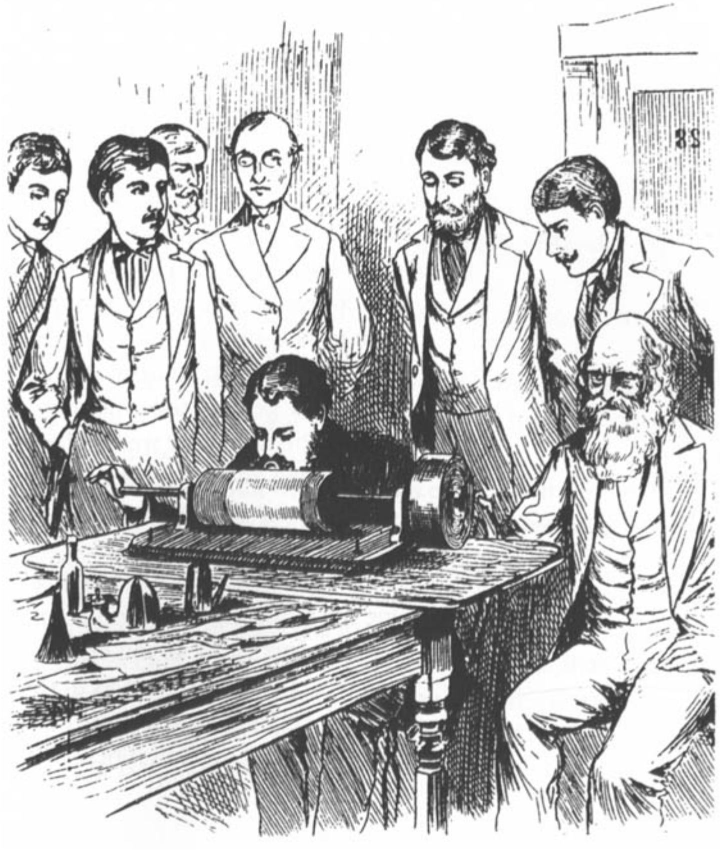
ALS, PHi, UHP. Letterhead of Charles H. Cheever. [a]"New York" and "187" preprinted. [b]Obscured overwritten letters.

1. See Doc. 1224.

2. On the design of these phonographs see Doc. 1195. They were being manufactured in the New York shop of Sigmund Bergmann, and on 18 March, Gardiner Hubbard wrote George Bradley, "Mr Cheever will have 25 Small Phonos— finished the last of this week Mr Johnson says he has orders sufficient to take the whole lot at once" (Box 1205, NjWAT).

3. On 14 March, Charles Cheever wrote Gardiner Hubbard:

> Consultation with Johnson first of this week and with Edison two or three times has resulted in my deciding that it would well for us to have a small lot of 25 of the long cylinder Phonograph made at once to be used for lecturing purposes, by long cylinder Phonograph I mean the larger one of the two that Edison made. Exactly how these should be put out and what royalty we should receive for lecturing purposes I have not exactly made up my mind though I have got the scheme in the rough in my head and will write you at length about it in a day or two, in the meantime I have two parties bidding on it and wish to give contract tomorrow afternoon for having them made as everydays delay counts against us. [Box 1205, NjWAT; see Doc. 1276 n. 1]



A phonograph demonstration in New York, with William Cullen Bryant seated at right.

4. William Cullen Bryant (1794–1878), the well-known poet, was a staunch Republican who had edited the *New York Evening Post* for fifty-nine years (*DAB*, s.v. "Bryant, William Cullen"). On 15 March, Charles Cheever wrote Gardiner Hubbard about the hundreds of persons who had come to the phonograph company headquarters to see the phonograph, including "William Cullen Bryant who has been here once and sent a request to have a chance to come here again and bring some friends. . . . Mrs Astor . . . requested me to bring one to her house and show it to about forty friends" (Box 1205, NjWAT). The *New York Daily Graphic* of 15 March shows Bryant at a phonograph demonstration in New York ("Singing and Talking by Machinery," Cat. 1240, item 403, Batchelor (*TAEM* 94:123).

5. Gardiner Hubbard had married Gertrude McCurdy of New York in 1846. Bruce 1973, 83.

-1247-

From Henry Bentley

[Philadelphia,] Sunday PM 3/10/78

We have been waiting for you all this PM to reply from M.S.[1] We found the repairs of[a] wires were not yet concluded at the burned bridge[2] so we got a wire to N.Y. and had a man watching out for you from N.Y. to work you around that way. But you were open[3] that way also they said. So we, in the meantime, went for Harrisburg &c with good success, as stated on the other leafs.[4]

We will wait for you here until dark and if the bridge wire[b] is not up by that time we will give you a test around by N.Y. to your place or vice versa any day or night you say this week.[5] I sent you some papers. And I thank you very kindly for the Phonograph Whatever the charge is inform me and I will remit. I am keeping Mr Orton posted of each days doings and I am satisfied[c] you will not regret the fruits of our labors in these tests—nor that you sent the articles here. The more we see of this Carbon Transmitter and the arrangements in connection for general uses the more important it seems to us.

In the little shower we had here on Friday the Bell folks in[c] this city had 30 of their telephones demagnetized and we had 3, which is in about the proportion of the number we each have in use, I judge.

Two drawings were made here yesterday of your Phono. One for a cut in the Graphic[6] and one for the Journal of the Franklin Institute.[7] If you choose to send me what you would wish to explain and claim as to the important features of your Carbon Telephone—in your own language—I will work the Telephone and explain it before the Franklin Institute here at the coming meeting.[8] Meetings Monthly and next one next week.

AL, UkLIEE, WHP. Letterhead of Philadelphia Local Telegraph Co. [a]“repairs of” interlined above. [b]Interlined above. [c]Obscured overwritten letters.

1. Bentley probably meant “M.P.”; that is, Menlo Park.
2. The Pennsylvania Railroad bridge at New Brunswick, N.J., had burned down the previous day. Cat. 1233:68, Batchelor (*TAEM* 90:86); *Philadelphia Inquirer*, 11 Mar. 1878, 1.
3. In American telegraph systems, when messages were not being transmitted the circuits were closed and electric current flowed continuously through the line. An open wire would have signified a break in the line.
4. Edison sent this letter to Preece, but the other leaves have not been found. However, the second enclosure accompanying Doc. 1204 would be appropriate were it not clearly dated “Feby.”
5. According to the Philadelphia Local Telegraph Co. logbook, they succeeded in making tests to Menlo Park on 10 March: “Making tests with Menlo Park via New York, 138 miles; also to Menlo Park direct; got talking distinctly, also singing; words in conversation sound muffled” (quoted in Bentley’s testimony, Evidence for Edison, TI 1:319 [*TAEM* 11:136]). These tests were conducted with both Edison and Batchelor (Bentley to George Prescott, Box 1093, NjWAT).
6. “The Speaking Phonograph,” *New York Daily Graphic*, 12 Mar. 1878, Cat. 1031:82, Scraps. (*TAEM* 27:781).
7. Plush 1878, 270.
8. See Doc. 1195 n. 2.

-1248-

From Theodore Puskas

Paris 10th [12th][a] March [18]78.

My dear Edison,

Just before leaving England I wrote you a long letter;—[1] I hope ~~I~~you got it all right.

I see by one of your letters that Nottage cabled you and sent also a letter.—[2] I never knew anything about it—till I got the[b] information from you.

That was at the time when he backed out from the first arrangement.— Brewer made then the ~~proposition~~ suggestion[b] that he should advance one thousand pounds. [-][c] I was mad at Brewer because he had no authority to act in the matter. Nottage seized right away the idea and cabled you—(as I see), because I declined his new proposition. I am glad that you left the matter ~~for settling to me w~~ with me to settle. Brewer knew all about the cable and the letter—but never said a word to me.— He is a great busy body.

Tomorrow afternoon I am going to show the phono to the members of the "Academy".—[3]

The patent for France has been granted a few days ago.[4]

As soon as I get the small phono which I hope is already coming, I will order here one thousand for the Exhibition.

I am also anxiously waiting for more[b] telephones.— The telephones I brought over with me wouldn't work very well.— I opened them & found that ~~that~~ the carbon disks were spoiled;— they were quite wet and fell to pieces when I took them out.— I cannot account for that,—but I know positively that there never came a drop of water near to the telephones since you handed the same over to me.— Can it be the effect of the see air?

I got your cable that the phonograph is perfect.[5] I congratulate you most heartily.

Please let me have a plate instrument as soon as possible.[d] We can sell here lots of them during the Exhibition.—

Tomorrow night I am off for Brussels.— I heard this afternoon that the belgian government is just now looking into the telephones.—[6]

I can work your phono now pretty well.— The other day when Preece lectured before the Institution of Civil Engineers I showed off your phono.—[7] It talked svery distinctly and so loud that they heard it all over the hall. There was plenty of applause and cheering.— I thanked in your name.— I don't know whether I mentioned it in my other letter that I showed your phono to the Crown prince of Austria.[8]

If you made an essential improvement on your phono, take a patent out[b] for it in England to strengthen your patent there.—

Preece is a pretty decent man, but rather on the Side of Bell. I think a have to work with him; he has great influence at the Post Office.—

Paris 12th March 78

I exhibited the phonograph yesterday before the members of the Academy, ~~wh~~ with what success you'll ~~be~~ see by the enclosed letter.—[9] I am just now off for Brussels and from there to London.— Received this morning Bachelor's letter informing me that small phono is shipped.[10]

More from Brussels or London Yours Very Truly

Theo. Puskas

Colonel Beetle is a very nice man.

ENCLOSURE[c]

PARIS, March 11, 1878.[11]

MY DEAR MONSIEUR BEETLE:

I have come in from the Institute[12] and will write you an exact account of the presentation of the phonograph, that you may know the details. I never saw such a success. When the Count du Moncel[13] commenced to explain the apparatus and the principles governing it, the greater number of the members of the Academy arose and approached it. M. du Moncel made the presentation in the name of Mr. Edison, and said that the latter had a representative here to exhibit it. M. Pasques[14] then spoke into the phonograph: "The phonograph presents its respects to the Academy." When the apparatus repeated this sentence, there was great excitement and a storm of applause, which was renewed after other sentences. When the presentation was finished, the Count du Moncel came to me and said that several members of the Institute desired to examine the apparatus more particularly. M. Pasques and I went down to the office of M. Dumas, the permanent secretary,[15] accompanied by the following members of the society: First, M. Herve Manson, the son-in-law of M. Dumas, senior professor;[16] second, M. Tresca, professor and director of the Conservatory;[17] third, M. Resal, professor in the Polytechnique School;[18] and fourth, a member whom I do not know. M. Tresca said to me: "We wished to see for ourselves, because, perhaps, some doubt might remain in the minds of certain members. Besides, I will tell you frankly that, some time ago, we went to the Grand Hotel to see a speaking machine.[19] Well, there was a ventriloquist behind it. We are perfectly certain that the invention is real and marvellous, but we wish to make it speak ourselves."[20] M. Pasques then put a new piece of tinfoil around the cylinder and spoke into the mouthpiece. M. Tresca turned the machine, which repeated what had been said. He then spoke himself, and had his own words repeated. M. Resal then spoke into the phonograph, which repeated what he had said.

These gentlemen departed in a state of enthusiasm. M. Herve-Manson said to me: "When I heard it, I applauded frantically."

I beg of you, dear monsieur, to accept my sincere congratulations.

I have little influence in the Academy, but I have already told you how amazed I was by the apparatus, and I beg of you to take the first opportunity of being my interpreter to Mr. Edison and of expressing to him my great admiration. Yours ever,

E. HARDY,[21] Engineer Electrician

ALS, NjWOE, DF (*TAEM* 15:339). [a]Second dateline appears below. [b]Interlined above. [c]Canceled. [d]"as soon as possible" underlined twice. [e]Enclosure is a PL (translation) in "The Wizard of Menlo Park," *New York Daily Graphic*, 10 Apr. 1878, Cat. 1240, item 500, Batchelor (*TAEM* 94:160).

1. Doc. 1237.

2. Neither Edison's letter to Puskas nor the Nottage letter and cable have been found. The earliest extant letter from Nottage is dated 7 March. DF (*TAEM* 19:215).

3. The Académie des Sciences was officially created in 1816 and remains the most prestigious general scientific society in France and a unit of the national government. Crossland 1992, 14–19, 50–56.

4. The patent had been granted on 19 February (see Doc. 1202 n. 4). As in the British patent, the phonograph was part of a telephone patent.

5. Not found; however, Edison made the same proclamation to Alfred Mayer on 2 March (Doc. 1229).

6. Puskas had been interested since sometime the previous year in arranging a telephone exchange system in Brussels but apparently did not establish one. See Doc. 1153; Holcombe 1911, 356.

7. Preece's talk, on 28 February, was for the Society of Telegraph Engineers, whose meeting was held on the premises of the Institution of Civil Engineers. Puskas's role in the event is reported (as "Puscus") in the 8 March issue of *Engineering*. "The Phonograph," Cat. 1240, item 449, Batchelor (*TAEM* 94:139); see also William Preece to TAE, 28 Feb. 1878, Cat. 1240, item 117, Batchelor (*TAEM* 94:117).

8. Prince Rudolf von Habsburg.

9. Puskas gave his own account of the event in an interview reported in a dispatch from 28 May. "Edison's Phonograph in Paris," *New York Daily Graphic*, 8 June 1878, Cat. 1029:146, Scraps. (*TAEM* 25:238).

10. Charles Batchelor wrote Puskas on 27 February; the phonograph had been sent to the express company three days earlier. Batchelor to Puskas, 27 Feb. 1878; Batchelor to Baldwin Bros. & Co., 24 Feb. 1878, Lbk. 1:369, 349 (*TAEM* 28:233, 221).

11. The original of this letter has not been found; another less complete translation is in DF (*TAEM* 97:718). This translation was published in the *New York Herald* of 29 March in an interview with Edison ("That Wonderful Edison," Cat. 1240, item 463, Batchelor [*TAEM* 94:147]).

12. The Académie des Sciences was officially one of several components of an overall National Institute. Crosland 1992, 50–58, 82–84, 87–90.

13. Count Théodore-Achille-Louis du Moncel made scientific and telegraph instruments, wrote numerous works of scientific reference and popularization, and served as an engineer and administrator for the French telegraphs. *DBF* 12:191; Butrica 1986, 202, 208; *DSB*, s.v. "Du

Moncel, Théodose Achille Louis" (both spellings of his first name were and remain common).

14. Puskas.

15. Jean-Baptiste-André Dumas, among the century's leading industrial and theoretical chemists, as well as a politician, prominent government official, and holder of various professorships, had been permanent secretary of the Académie des Sciences since 1868. *DSB,* s.v. "Dumas, Jean-Baptiste-André."

16. Charles-François-Hervé Mangon was chief engineer (specializing in rural drainage, irrigation, and hydraulics) in the government's foremost engineering division, the Ponts et Chaussées, and a professor at its professional school. *Gde. Ency.,* s.v. "Mangon (Charles-François-Hervé)."

17. Henri-Edouard Tresca was undersecretary of the Conservatoire des arts et métiers, its professor of industrial mechanics as well as that for applied mechanics at the École Centrale des Arts et Manufactures, and had been commissioner general for the 1855 Universal Exposition in Paris. *Gde. Ency.,* s.v. "Tresca (Henri-Edouard)."

18. Henri-Amé Résal, professor at both the École Polytechnique and the École des Mines and the second editor (from 1874) of *Liouville's Journal,* had been a mining engineer and superintendent of railways; he specialized in mathematical and engineering mechanics and thermodynamics. *WWWS,* s.v. "Résal, Henri-Amé"; *DSB,* 8:382b, 11:78b.

19. Nothing specific has been found about this event, but see Du Moncel 1974, 261.

20. Some accounts in the press indicated that many observers voiced intense scepticism, particularly when Du Moncel failed in his first attempt to make the phonograph work himself (for quotations and discussions see Charbon 1981, 48–49 and Du Moncel 1974, 244–46). Later it was claimed that the eminent chemist Henri Sainte-Claire Deville, professor at the École Normale Supérieure, had been the most outspoken of the scoffers ("The Present Bugbear of French Savants," *Sci. Am. Suppl.* 6 [Dec. 1878]: 2452).

21. Edme Hardy was an award-winning maker of scientific and telegraph instruments (notably chronographs) and the French manufacturer for Edison's electric pen. He was soon manufacturing Edison phonographs as well. Turner 1983, 75 (fig. 9); Butrica 1986, 164, 185 n. 36, 205; Doc. 1259.

-1249-

To Henry Edmunds, Jr.

Menlo Park N.J. Mch 12—78

Friend Edmunds

(Yours of 26 at hand)[1]

I see Preece exhibited your tube experiment at the Royal Institution =[2] One of my assistants leaves[a] for England on the .16. and carries with him 2 Small phonographs:[3] he understands how to talk them right out I will instruct him to go with you and assist you when you deliver your lecture.[4] I will let you know if anything comes up new= See Scientific American Supplement of Mch 16—No 115[b] containing a long and very funny article on the phono=[5] also get Scribners Monthly and the Popular Science Monthly for April which will soon be out= these especially P.S.M. contain some Scientific Experiments by Prof Mayer of Hoboken= Since you left I have the articulation perfect reproducing whispers= Saphire points very much like the shape of a needle point and proper dampening ~~gives~~ of diaphragm gives it= Carbon Telephone has passed a severe test under WU Tel auspices, worked[c] 720 miles amid other wires at noon when traffic was going on=[6] 100 miles it works loud & perfect= 2 cells of battery at each end only used[7] many improvements have been made in last 3 weeks Yours

T A Edison

ALS, Pritchard. [a]Obscured overwritten letter. [b]"No 115" interlined above. [c]Interlined above.

1. This was a reply to Edison's letter of 12 February (Doc. 1205). Edmunds expressed his disappointment that Edison could not "put the phonograph into my hands commercially," but indicated that he would be pleased to "lecture & exhibit it scientifically." DF (*TAEM* 15:288).

2. This was Edmunds's "phonoscope" in which the vibrations of a diaphragm varied the rate and appearance of electrical discharges in an evacuated chamber (a Gassiot tube). Preece demonstrated one in February during his lectures on the phonograph before the Royal Institution and the Society of Telegraph Engineers. He apparently sent Edison the page proofs of the Society's 1878 *Proceedings* (pp. 68–74) containing the text of his lecture at the 27 February meeting ("The Phonograph," Cat. 1030:45, Scraps. (*TAEM* 25:281). An extensive description and illustrations of the device were published in the 17 August *Scientific American Supplement* ("The Phonoscope and the Phoneidoscope" [6: 2182], Cat. 1032:52–53, Scraps. [*TAEM* 27:846]); another description is in Tritton 1993, 38.

3. James Adams; see Doc. 1258 n. 2.

4. In his 26 February letter (see note 1), Edmunds told Edison that he had "promised to read a paper before the Society of Arts—& am only waiting your notes diagrams & Phonograph," which Edison had promised in his letter of 12 February (Doc. 1205). The Royal Society of the Arts was Britain's most prominent organization for promoting technical progress.

5. Under the title "The Speaking Phonograph," the *Scientific American Supplement* (5:1828–29) reprinted an article that had first appeared as "A Marvelous Discovery" in the 22 February 1878 *New York Sun.* Cat. 1240, item 378, Batchelor (*TAEM* 94:115).

6. See Doc. 1239 n. 3.

7. This is in contrast to the 125 carbon cells employed during a musi-

cal telephone demonstration between New York and Albany in August 1877. One hundred miles is roughly the length of the telegraph line between Philadelphia and New York. Prescott 1878c, 281–83.

-1250-

To Uriah Painter

Menlo Park N.J. Mch 12—78

U.H.P.

Thanx for the patent book=[1] I cannot spare time from the phono to go at Aerophone just yet.[2] I will send you one of the small phonos just as soon as I get it from the japan shop. I think EH.J. will make a success in his new position. I told him what he should go for dollars & cents for the Phono Co as they wasn't after glory but the rhino[3] of an admiring public. I will help you get toy contract I it is possible. I shall undoubted get 2 or 3 news things out in 1879— and will give you a hack at them= Yours

T.A.E.

ALS, PHi, UHP.

[1] Unidentified.

[2] Newspaper notices of the aerophone began to appear within a few days, and on 18 March, Gardiner Hubbard told George Bradley that "Mr Edison has never made a single airophone theoretically it is perfect. What practical difficulties there may be in the way he does not know Mr Edison is at work all the time on the Phonograph & will do nothing else, until he has finished that" (see also Cheever to Bradley, 16 Mar. 1878, both Box 1205, NjWAT). Soon after the appearance of the first articles about the aerophone, Edison began to receive letters of inquiry about the invention. In reply to two letters from Allen & Co., Edison wrote, "Aerophone not perfected sufficiently for introduction or sale= The cost will be small at any rate" and indicated "that phono is taking up so much my time at present that aerophone is left in abeyance Expect to take it up in little while when will notify & they can come down & see it." To William Kimball & Co., who wanted him to construct an aerophone to advertise Vanity Fair tobacco, Edison replied, "I will do what you desire but owing to time consumed on my phonograph I will be unable to perfect it for some time you will hear of it through the papers." Edison's answers are marginal notes on Allen & Co. to TAE, 20 and 22 Mar. 1878 and Kimball to TAE, 25 Mar. 1878, all DF (*TAEM* 15:373, 387, 400).

[3] Slang term for money. Farmer and Henley 1970, s.v. "rhino."

-1251-

Charles Batchelor Diary Entry

[Menlo Park,] Tuesday Mch 12 1878

Test with Philadelphia by New York 130 miles not very good= direct 69 miles very fair after we got through found one transmitter had been breaking circuit & mashed fluff[1] & burnt cork afterwards made a thick tin diaphragm & used spiral springs to press fluff[2] Kept getting better as we used stiffer springs & finally put on solid tube & got better articulation than on anything else[3]

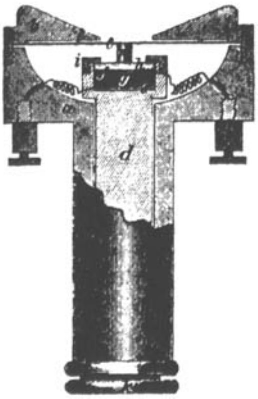
D, NjWOE, Batchelor, Cat. 1233:71 (*TAEM* 90:87).

1. I.e., the carbon button; see, e.g., Doc. 407.

2. According to Bentley's testimony in the Telephone Interferences, on the following day they made another test between Menlo Park and Philadelphia "'with new disk spring; test very satisfactory.' Mr. Edison wrote to me and stated that he had made a spring; he sent me a spring made of brass, and thought there was great advantage in it. After experimenting with it, however, we did not agree with him. The articulation, when conversation was carried on in a low voice, was very rough." TI 1:319 (*TAEM* 11:136).

3. In Prescott 1878c (pp. 226–27), Edison wrote:

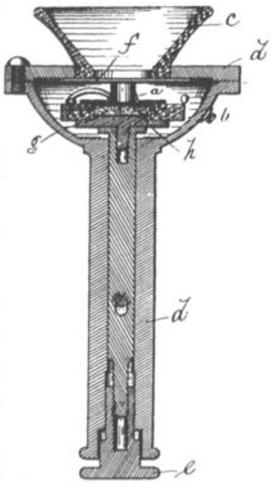
> While engaged in experimenting with my telephone for the purpose of ascertaining whether it might not be possible to dispense with the rubber tube which connected the diaphragm with the rheostatic disk, and was objectionable on account of its tendency to become flattened by continued vibrations, and thus necessitate the readjustment of the instrument, I discovered that my principle, unlike all other acoustical devices for the transmission of speech, did not require any vibration of the diaphragm—that, in fact, the sound waves could be transformed into electrical pulsations without the movement of any intervening mechanism.
>
> The manner in which I arrived at this result was as follows: I first substituted a spiral spring of about a quarter inch in length, containing four turns of wire, for the rubber tube which connected the diaphragm with the disks. I found, however, that this spring gave out a musical tone which interfered somewhat with the effects produced by the voice; but, in the hope of overcoming the defect, I kept on substituting spiral springs of thicker wire, and as I did so I found that the articulation became both clearer and louder. At last I substituted a solid substance for the springs that had gradually been made more and more inelastic, and then I obtained very marked improvements in the results. It then occurred to me that the whole question was one of pressure only, and that it was not necessary that the diaphragm should vibrate at all. I consequently put in a heavy diaphragm, one and three quarters inches in diameter and one sixteenth inch thick, and fastened the carbon disk and plate tightly together so that the latter showed no vibration with the loudest tones. Upon testing it I found my surmises verified; the articulation was perfect and the volume of sound so great that conversation carried on in a whisper three feet from the telephone was clearly heard and understood at the other end of the line.



The telephone exhibited at the Franklin Institute on 20 March.

FIRST RIGID-DIAPHRAGM TELEPHONE TRANSMITTER Doc. 1252

On 12 March, Edison first substituted a rigid brass tube for the rubber tube pressing down on the carbon during telephone tests between Menlo Park and Philadelphia.[1] This instrument incorporated that change and contained an ivory disk, which Edison replaced with a glass disk in the telephone he sent to Henry Bentley for exhibition at the Franklin Institute on 20 March.[2] It also appears to have had a thicker metal plate in place of a thin diaphragm, another change Edison made on 12 March. Bentley subsequently modified the telephones he was testing in Philadelphia to include the 12 March design changes.[3]



A carbon telephone transmitter with an iron handle used in tests in Philadelphia.

1. See Doc. 1251; cf. Doc. 1125.

2. Bentley's testimony, TI 1:319–20, 328 (*TAEM* 11:136–37, 141). Plush 1878 (p. 269) describes the Franklin Institute telephone:

> *g*, the carbon disc.
>
> *e* and *f*, two thin platinum plates, connected in the local circuit.
>
> Resting on the platinum, *f*, is a small disc of glass, *h*, of the same diameter as the carbon. On this glass plate rests a short brass tube, *m*, fastened to the round metal plate, *c*. This plate does not vibrate as the diaphragm in the ordinary telephone, being quite rigid; it simply arrests the atmospheric concussions, and conveys them, by direct contact, to the carbon disc.
>
> *b*, the mouthpiece.
>
> *a*, hard rubber case.
>
> *d*, a core extending through the handle, from the platinum, *e*, to the nut, *k*, to which it is connected by a movable screw, so arranged as to be capable of any desired longitudinal adjustment.

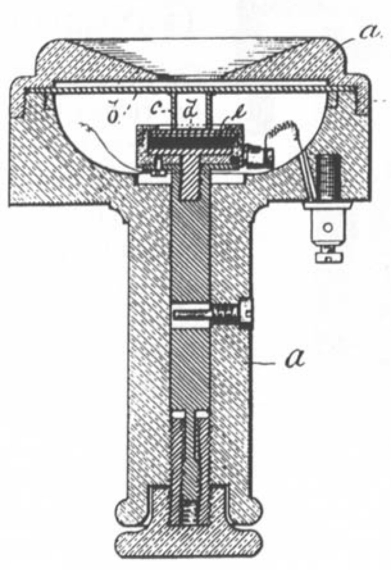
3. See Bentley's testimony, TI 1:323, 325, 328, and "'Bentley's Exhibit' Edison's Carbon Telephone No. 1" and "'Bentley's Exhibit' Edison's Carbon Telephone, March 25th 1878," TI 2:534–35 (*TAEM* 11:138–39, 141, 662–63). On 22 March, Batchelor made a measured drawing of an iron-handle transmitter with a longer carbon-fluff holder. Batchelor erased and redrew the mouthpiece in the drawing, changing it from a cone to a cupped shape. Henry Bentley received an instrument with the mouthpiece as first drawn, but indicated that this design did not give "satisfactory results" (NS-78-011, Lab. [*TAEM* 7:918]; "'Bentley's Exhibit' Edison's Carbon Telephone No. 4," TI 2:537 [*TAEM* 11:665]).

-1252-

Experimental Model: Telephony[1]

[Menlo Park, N.J., March 12, 1878?][2]

a. hard rubber
b. tinned iron
c. Brass
d. ivory disk
e. carbon



M (historic drawing) (10.5 cm × 7.5 cm), NjWOE, TI 2:531 (*TAEM* 11:659). Photolithograph of drawing of exhibit instrument, prepared for printed record.

1. See headnote above.

2. This was entered into evidence in the Telephone Interferences with a date of 26 November 1877 (see *TAEB* 3:642 n. 1). However, it is clearly the modified design from about 12 March 1878.

-1253-

From Edward Johnson

Bu[ffalo] 3/13/78

My Dr E

Notice the Item at bottom of this Page—[1] The W.U. (Phelps) telephones are being put out here in great profusion[a] and they are styled the Edison Telephone—not by written—but by a sort of tacit understanding Clearly they are trading on your name— What do you think of this for a piece of cool impudence[2] Speaker worked O.K.—but weak last night Bu to RH.—[3]

My clock work broken by N.Y. Central Bag. Smashers had to return it to NYork my man is in a bad way for money to pay for springs—I think it would be only fair if you would advance him 30 or 40$ on a/c Hastily

Johnson

ALS, DF, NjWOE (*TAEM* 15:353). [a]Obscured overwritten letters.

1. This letter was written on three small pieces of paper about the size of a Western Union telegram form. No item appears at the bottom of any of them.

2. In a 22 March letter to George Bliss, Enos Barton asked him to intercede on behalf of Western Electric to

> convince Edison of the fact that his best interest, telephonically, lies in cooperating with us to secure the adoption of his transmitting telephone by the Gold & Stock.
>
> I think that [Elisha] Gray takes very little stock in having the telephones go by his name. They are making the Phelps instruments in New York, and pressure is being used to extend that style and title of telephones, as you and Edison well know.
>
> I believe that Edison's instrument is of sufficient merit to secure its adoption sooner or later, certainly for a transmitting instrument, over both the Phelps duplex and the Gray bi-polar. [DF (*TAEM* 19:664)]

3. Buffalo to Rochester; see Doc. 1224.

-1254-

From George Barker

Philadelphia Mch. 14. 1878

My dear Sir:—

Thanks for your letter at hand this morning.[1] You may well be satisfied with your telephone after the splendid success of yesterday. The discovery which you mentioned that the diaphragm should not vibrate is as surprising as it is important. Your telephone must take the front rank, certainly for long lines. I congratulate you cordially. Can you loan me one of your transmitters some time for experiment? I want to try it on my big induction coils to see if I can't get talk loud enough to hear across a room. Can I in any way make talk heard over the Academy?[2] What do you think of talking through the motorgraph simply to show loudness of talk? I remember you received on the motorgraph loud enough to be heard a hundred feet.

As to the phonograph I want of course to show that. But the one Mr. Bentley has here can hardly be heard far enough, Mr. Adams said the large one of yours could be heard 200 feet. What would you suggest that I use and what experiments shall I show with it.

I hear that Mayer's article will not appear in the April no.

Yours truly

George F. Barker

⟨W.H.P.[3] Experiment was from Menlo Park to Phila via[a] NY 138 miles way wire runs dif routes. 11 Receivers at

Phila— They heard 2 columns of newspaper read & many got it 2 feet from Telephone= Barker is prof physics Edison⟩

ALS, UkLIEE, WHP. [a]Obscured overstruck letter.

1. This letter, dated "12—78," says:

> You know I am good at a promise, but really this time I will fix you up as I am more satisfied with my Telephone. You better make your Lecture on the spkg phonograph= as Johnson finds in his travels that the phonograph takes away all interest in the Telephone; —Mayer has article April No. Pop Sci Mo. Look for it= [UHP]

2. Academy Music Hall in Philadelphia; see Doc. 1239.,
3. Edison forwarded this letter to William Preece.

-1255-

From Henry Olcott

N.Y. Mch 15, '78

Dear Sir.

As the visit of Mme Blavatsky[1] and myself, today, was made conditional upon receiving a telegram from you on Wednesday Evening, and no word was received from you, we, of course have remained in the city.[2]

The copy of "Isis Unveiled"[3] awaits your coming to Mme B's house—302 W 47th St—which she trusts may not be long deferred. If you should find it impossible to call in the morning, or before her dinner hour—6 pm—you will do well to let her know a day ahead, as she has engagements at present that take her out frequently, and she would not like to miss the pleasure of seeing so thoroughbred a Heathen—as you say you are. Good people of our kind are scarce in this pretended Christian country! Yours

H. S. Olcott[4]

ALS, NjWOE, DF (*TAEM* 15:357).

1. Helena Blavatsky was the Russian-born founder of the Theosophical movement, a mix of spiritualism, occult ancient science, and ideas from ancient Egyptian and Asian religions. In 1875, she joined with Henry Olcott and William Judge to found the Theosophical Society in New York City. On 18 December 1878, Blavatsky and Olcott sailed to London, where they formed a branch of the Theosophical Society; they then traveled to India where they established the Society's headquarters. *DAB,* s.v. "Blavatsky, Helena Petrovna"; the most recent biography of Blavatsky is Cranston 1993; Gomes 1994 provides an extensive bibliography on Theosophy.

2. On 11 March, Olcott had wired Edison from Metuchen, "Came here to see you on important business. Return by next train will go

straight to Church St" (DF [*TAEM* 15:346]). Later that day he wrote Edison:

> Mme Blavatsky hopes you will be able to dine with her on Thursday at 6 pm and will be pleased to explain to you something about the occult forces that you desire to know.
>
> If, however, you shall be unavoidably prevented from coming in town on that day, & will telegraph her on Wednesday evening so that she can make necessary arrangements, she will come out, agreeably to your polite invitation, with me on Friday by the 11 am train & return at 3 o'clock. [DF (*TAEM* 15:344)]

Edison and Blavatsky never met (Blavatsky to TAE, 14 Dec. 1878, DF [*TAEM* 16:514]). However, Olcott did go to see Edison, on behalf of U.S. Commissioner Richard McCormick, regarding his exhibit for the Exposition (Olcott to TAE, 20 Dec. 1889, DF [*TAEM* 125:767]). According to Olcott's *Old Diary Leaves: The History of the Theosophical Society,* during this visit

> Edison and I got to talking about occult forces, and he interested me greatly by the remark that he had done some experimenting in that direction. His aim was to try whether a pendulum, suspended on the wall of his private laboratory, could be made to move by will-force. To test this he had used as conductors, wire of various metals, simple and compound, and tubes containing different fluids, one end of the conductor being applied to his forehead, the other connected with the pendulum. As no results have since been published, I presume that the experiments did not succeed. [Olcott 1895, 467]

These experiments may have been those described in Doc. 499.

3. The two-volume *Isis Unveiled: A Master-key to the Mysteries of Ancient and Modern Science and Theology* (Blavatsky 1972) was Blavatsky's first major work on Theosophy. Although she claimed that it was dictated by "My Master, and occasionally others whom I knew on my travels years ago," Blavatsky took extensive passages directly from other, unattributed works. Edited by Henry Olcott, *Isis Unveiled* was published in 1877. The first volume, titled "Science," included a discussion of Edison's 1875–76 etheric force experiments (p. 126); the second volume was titled "Theology." A discussion of *Isis Unveiled* is in Campbell 1980, 32–39.

4. Before the Civil War, Henry Olcott had been an agricultural teacher and journalist, but by the time he met Edison, he had become a lawyer, although he also continued to act as a journalist. Olcott had met Blavatsky in 1874 while writing a series of articles for the *New York Daily Graphic* on the spiritualist Eddy brothers. When Olcott and Blavatsky formed the Theosophical Society in 1875 he became president and Blavatsky served as corresponding secretary. In 1878 he was also honorary secretary of the Citizen's National Council, formed to promote the passage of Congressional legislation authorizing United States participation in the Paris Universal Exposition. *DAB,* s.v. "Olcott, Henry Steel"; Olcott 1975, 467.

-1256-

Edward Johnson to Uriah Painter

New York 3/15th 1878[a]

My Dr U.H.

Just got back—and am filled with astonishment at the astounding rapidity with which things have been developing here— I told Orton in the interview I had with him to give Edison a chance to put his Telephone into practical operation and he would soon see what it could do. He acted on the advice—sent for Edison told him to send his man with Telephones to Bentley at Philada which Edison did— Bentley was instructed to do[b] just ~~wich~~ what he pleased, & Merrihew to assist him in every way— The result has been as I predicted—and more— Bentleys practical mind suggested several changes which Edison made to the great advantage of the thing. Most Important one was to dispense with the elastic rubber cushion between the Diaphragm and the little cup that holds the Carbon as it was not vibration that he required but simply pressure—[1] Edison saw it at once—& Presto—what a change— A thicker plate was at once substituted & clearer articulation obtained—& a volume of sound & far reaching current obtained so far in excess of the capabilities of[b] the magneto as to bring Bentley on to NYork yesterday morning to urge Orton to close the matter up at once Orton referred him to the Ex[ecutive]. Com[mittee].[2] He saw them & they are Hell-bent on bringing the matter to a close— Orton asked Edison for his figures & the Dam fool gave them $6000—that too in the face of the fact that he held in his hand an offer of $12 000 lbs for England—& was getting his man ready to go over on Mondays steamer— (we might have had that if you could have been here to find the money'd[c] men)— Orton goes to Washn tonight to return Tuesday—when he has sent word to Edison he will be ready to close the matter up— The Electricians Dept. have[b] got their tails between their legs—Bentley told me today it worked beautifully between Pha & Pittsburg—Pha & Washn.[3] Pha & NYork & Pha & Menlo Park via New York— He told Phelps to throw away his magneto Telephone it was no where that the Carbon Telephone was the telephone of the future.

Now are you the man to grasp this occasion & get out of it something for you & I. Edison will never give us a Cent for what we have done— My constant repetition of the prophecy that this would be the outcome of his Telephone, will go for so much chaff in his view. We must do something— Question—will he put up his figures? I think if you will come on & help me we can make him do it. And I think I can show him that Orton would just as leave he would have asked more—What Orton cares for is to have Edison present some good & complete invention to the Ex. Com. under the contract[4] which he O. made against their judgment— The price is not so much of a consideration with him as the satisfaction of having the correctness of[d] his judgment confirmed— He (O) told Miller in regard to the Englash offer of 12,000 pounds that he (O)—was going over shortly and he was satisfied he could have got that much per Annum—that it would have been cheap at that— If cheap at $12 000 lbs ~~whi~~ for England—what is $6000. in this Country— the whole thing is so supremely ridiculous that I swear all the time because I was not here to prevent him from doing such a foolish thing. —Yet I am so pressed for money that I am compelled to work every wire I can obtain control of

I am going out to Menlo tomorrow morning to see Edison—& feel him—& if I find him weakening ever so little shall want you to come on tomorrow night & spend Sunday with him & me—& will simply Telegraph you to come.

My trip was very successful I made 2 bang up (Eloquent?)—speeches 1½ hours long on Edisons inventions—received hearty congratulations all around (Buffalo & Rochester)—got $100. for each— Auburn was a failure so I had to compromise—crowd was poor—a Hose Co— I got home with $150. clear—that helps. The parties I have been postponing are pressing me by mail & telegraph—and I recd offers for 16 Engagements[b] while on this trip— One man wants to engage me for a trip from Cleveland to Milwaukee & back through Canada—8. in all Another for Oswego Utica & again at Syracuse—another for five towns in Canada—& I have letters here from Indiana & Illinois urging me to come out that way.— in lieu of all this I am idling here—& not a word said as to whether I am even to be paid my board— Again— If I exhibit Edisons Musical Telephone I must use his speaker—as I did on my last trip—working it beautifully between Bu & Rochester 70 miles— As that is the property of the WU Co—I am doing my own friends a positive Injury—[b] when I show as I can so conclusively that this Carbon Telephone is so superior to theirs—(I can whisper 50 miles) Was ever a man so demned unlucky heres money floating all about just baskets full of it thrown into ones face—& I've been working ~~for the~~ for these thing on the hope that when they came to a head I would be there— Tell me before its too late how to manipulate this state of things to make my knowledge & Electrical competency of some utility to me Yours Truly

E H. Johnson

I'll send you papers when they reach me— I travelled from point[b] to point—just ahead of them

ALS, PHi, UHP. Letterhead of Charles Cheever, Treasurer. Painter later listed shareholders of the Edison Speaking Phonograph Co. at the end of the letter. [a]"New York" and "18" preprinted. [b]Obscured overwritten letters. [c]"d" interlined above. [d]"the correctness of" interlined above.

1. According to Bentley's testimony in the Telephone Interferences:

> Mr. Edison placed a piece of metal underneath the diaphragm in order to improve its articulation. This piece of metal was not suggested by me, but I stated to him that he must have some substance there which would not expand and contract so much as the rubber tubing which he had placed there. I thought a piece of hard wood would be best, but it was difficult to hold the wood there in a proper position always, so he soldered a small piece of brass tubing underneath the diaphragm. This we continued to use. Mr. Edison also sent me a spiral brass spring to go underneath the diaphragm on the button, but we thought it caused too great vibrations. [TI 1:327 (*TAEM* 11:140)]

2. The members of the Western Union Board of Directors who sat as the Executive Committee were William Orton, William Vanderbilt, Edwin Morgan, Augustus Schell, Harrison Durkee, James Banker, Alonzo Cornell, Hamilton Twombly, Norvin Green, Joseph Harker, and Samuel Barger. Western Union 1877.

3. According to the Philadelphia Local Telegraph Co. logbook, Merrihew was in Washington on a test line 140 miles and they "got what was said distinctly." Bentley's testimony, TI 1:319 (*TAEM* 11:136).

4. Doc. 876.

-1257-

Memorandum to William Orton

[Menlo Park, c. March 15, 1878][1]

Memorandum.

I commenced experimenting on speaking Telephones about August 1875=[2] which is I think earlier than any other person.

I have continued it unremittingly to date as the record I herewith present will show.

I believe myself to be the legal inventor of every speaking Telephone yet devised. I disclaim in equity however any moral right to the magneto Telephone but I believe I can prove that I was the first to devise apparatus whereby oral communication could be effected on that principle, hence a legal title.

Up to this date no one disputes with me my claim to be the sole inventor of the carbon Telephone.

Tests thus far made show the carbon Telephone to be the only Telephone applicable to general Telegraphy.

I have 12 applications 1 patent, 1 caveat and records from 1875 to date, which I herewith submit.[3]

The carbon Telephone was invented previous to my contract of March 22, 1877.[4]

In accordance with your expressed desire for an immediate settlement and transfer of my Telephone interest as they now stand I named the following offer.

Six thousand dollars per annum for seventeen years payable in monthly instalments and payments in each and every year guaranteed now by the WU Telegraph Co The documents are accordingly submitted[5]

Thos A Edison

ADS, DSI-NMAH, WUTAE.

1. Edison had made the offer in this memorandum by 15 March. See Doc. 1256.

2. See *TAEB* 2:524–25.

3. The issued patent is probably U.S. Patent 198,087. It includes figure 12 of Caveat 75, which Edison later claimed was the "First Telephone on Record" (see *TAEB* 2:720, 723 n. 17). Other telephone-related applications later issued as U.S. Patents 203,013–203,018, 208,299, 474,230, 474,231, 492,789. The other two applications are probably Cases 145 and 148, executed on 13 and 24 December 1877. Caveat 76A was executed about 28 February 1878 and filed on 8 March; it included 110 drawings (Doc. 1227 n. 1; TAE to Painter, c. 8 Mar. 1878, UHP; Cat. 1146, Lab. [*TAEM* 6:624]). For the record of Edison's experiments see Doc. 1232 n. 2.

4. Edison used carbon in his telephone experiments as early as October 1876 (Doc. 799). Although he did not execute his first patent application for a carbon telephone until 18 April 1877 (Case 130), the design included in that application dates from 9 February 1877 (Doc. 860).

5. Edison and Orton met on 21 March following Orton's return from Washington. The next day, Orton wrote Edison concerning his understanding of their interview and indicated that

> although by the terms of the contract we are entitled to have "three months satisfactory trial" after the complete issue of letters patent, I am not disposed to avail myself of so much time, and yet it will be necessary for us to have reasonable and proper time in which to make such trials as shall be deemed advisable. I trust, therefore, that you will furnish us with at least one set of Telephones as soon as they can be produced, and as soon thereafter as a satisfactory trial is had and an examination can be made of your pending claims for patents, I shall be ready to close up the matter. [DF (*TAEM* 19:666)]

There are two draft responses to Orton's letter on the back of a 23 March letter from F. M. Beall of Philadelphia. One of these, apparently written by Josiah Reiff, complained that Orton's letter "does not accept my offer but makes a new proposition," then declined to accept it and asked for the appointment of arbitrators to determine the price the company should pay Edison for his telephone as set forth under the terms of the 22 March 1877 agreement (DF [*TAEM* 19:670]). Edison's own draft protested that

> As the telephones have already had an exhaustive test by an officer of your appointment Mr Bently and as my whole experiments & patents matter since 1875 have been a matter of record and acccessible to the officers of your Co having that matter in charge I hope you will close the matter at once as my offer was made very low and based upon the supposition that you were ready to close the contract at once but if I am to be delayed by officers of your Co who are personally inimicable to my interest I shall withdraw the offer. [DF (*TAEM* 19:669)]

-1258-

To William Preece

Menlo Park N.J. Mch 18= 78=

Friend Preece.

At last Telephones=[1] I send one of my assistants Jas Adams who you will perhaps remember, with apparatus and he has instructions to conduct whatever experiments you desire on B[ritish] P[ost] O[ffice] Telegraphs=[2] Please give them the hardest tests you can under all conditions, as they stand every test here: 720 miles I have hopes that even with your reverse currents and greater induction that they will still be found valuable as an adjunct to your small station system=[3] I think after full investigation that you will conclude that the Carbon Telephone is a great advance in the art, Telephonic & otherwise= If tests are successful I should like to place them on your lines on a small royalty= I will have Mr Orton send you copies of the Report of the Very Exhaustive Philadelphia tests= Mr Orton has accepted my offer of a royalty of $6,000. per year with a remark that I was reasonable; and that he was entirely satisfied I refer you to him for any information of that character=[4] I see you are announced for a Phonograph Lecture before the Physical Society=[5] Mr A will stay a month if you so desire= Yours

T A Edison

ALS, UkLIEE, WHP.

1. On 15 March, Edison had cabled Preece: "Telephone great success Adams leaves for England Tuesday with apparatus tell Brewer & Jensen Puskas" (WHP).

2. James Adams sailed on 19 March on the *Montana*. He took with him two sounder brackets, two relay brackets, two bells, 2 three-cell battery boxes, six carbon transmitters and six Bergmann receivers, one "Iron core Receiver," one "cut Transmitter," diaphragms for the receivers, a box of carbon buttons ("fluffs"), a galvanometer, a 600-ohm induction coil, eight cords, two phonographs with tinfoil, miscellaneous tools, and "Diagrams of Sounder & Relay brackets diagrams to work in circuit containing Morse insts & permanent battery also for a long ckt with permanent battery." Cat. 1233:78, Batchelor (*TAEM* 90:92); Batchelor memorandum, 18 Mar. 1878, DF (*TAEM* 18:439).

3. By reverse currents, Edison is referring to the alternating currents used with the Wheatstone ink-recording automatic, which was used extensively on British lines and would have caused extensive crosstalk (induction) problems on telephone lines. The small station system was probably the London District Telegraph, established in 1859 and made part of the Post Office system during the nationalization of the telegraph. Preece 1877, 703; Kieve 1973, 56–59, 160, 167, 169.

4. It is not known if Orton sent Preece copies of the report on the Philadelphia tests. Preece did write Orton for information and received a cable from him stating that "Edison has done it can talk perfectly between New York & Philadelphia on regular morse wires twenty to thirty on a pole & running through short cables." Orton to Preece, n.d., WHP.

5. On 2 March, Preece lectured "On Mr. Edison's Phonograph." The London Stereoscopic and Photographic Co. subsequently "issued an interesting shilling pamphlet" which included extracts from Preece's lecture "and the reports and interviews of several American journalists with Mr. Edison." "Proceedings at the Meetings of the Physical Society of London," *Proceedings of the Physical Society* 3 (1878): 2; "The Phonograph," *Tel. J. and Elec. Rev.* 6 (1878): 255, Cat. 1030: 19, Scraps. (*TAEM* 25:265).

-1259-

From Theodore Puskas

London. W.[a] 18th March '78

My dear Edison,

I received yesterday in Paris the enclosed letters from Vallance & Vallance.—[1]

This morning I arrived here from Paris and unpacked the small phono.—[2] The mouthpiece was broken off, the ferrotype disk cut through ect. ect.— I find that three of the screws by which the phono was fastened to the bottom of the box got loose that is, they were entirely out[b] and the phono was knocked ~~towards~~ against[c] the top of box till the mouthpiece broke off.— The screws are too small, I think they ought to go through the bottom and be[c] fastened to it from the outside by nuts.

I showed the phono to Nottage but naturally could not work it.— Tonight I am again going over to Paris and will see ~~there~~ for how much I can get them manufactured there. If the difference in price between American & french make is not great then Nottage will give orders at same place where I order mine for the Exhibition. I think Hardy will be my man;—he is also making your pens.— Nottage may perhaps order some phono's in France and some in the States.—[3]

I have not received as yet the tinfoil.—[4] Am also anxiously waiting for the telephones.

My trip to Brussels was very satisfactory,—everybody was enthusiastic about your phono.— I think I have now to stop with exhibiting the phono—till I get at least several hundred ready for the market.[5] The excitement is already great.— They write in every parisian paper long articles about it.[6]

More from Paris Yours truly

Theo. Puskas

Hope you will soon send over all the things you want to have exhibited besides the phono, Telephone and pen.

ALS, NjWOE, DF (*TAEM* 19:218). Letterhead of the Langham Hotel, Portland Place. [a]Place preprinted. [b]"that is . . . out" interlined above. [c]Interlined above.

1. These letters have not been found, but were no doubt related to concerns by the London Stereoscopic and Photographic Co. about the potential legal strength of Edison's British Patent 2,909 (1877). On 7 July, Edison's British patent solicitors, Brewer and Jensen, sent Vallance and Vallance a detailed, expert analysis of that patent both in terms of the technology and of British patent law and practice (Miller [*TAEM* 28:1131]). Nothing further is known of Vallance and Vallance.

2. This demonstration phonograph had been sent late in February. See headnote p. 63.

3. It is unknown if Edme Hardy manufactured any phonographs for the London Stereoscopic and Photographic Co. They appear to have had their phonographs manufactured in Britain, probably by Augustus Stroh. See headnote p. 63; Docs. 1301 n. 3, 1310 n. 5, and 1645.

4. On 4 March, Edison had sent fifty feet of various thicknesses of tinfoil. TAE to Puskas, 4 Mar. 1878, Lbk. 1:404 (*TAEM* 28:266).

5. No records have been located regarding the number of phonographs Puskas had manufactured.

6. The *Paris Advertiser,* an English-language paper, noted on 9 May that "Edison's phonograph, which is shown four or five times a day at the Salle des Conférences, on the Boulevard des Capucines, is having a great success in society circles at Paris" (Cat. 1029:60, Scraps. [*TAEM* 25:191]). An example of Parisian press reports about the phonograph is "Phonographe, Téléphone. Phonautographe, Plume Électrique" in the 6 April issue of *Le Monde Illustré* (Cat. 1029:150, Scraps. [*TAEM* 25:240]); flyers with text in six languages advertising these demonstrations are in Cat. 1240, items 737–38, Batchelor (*TAEM* 94:258).

-1260-

Alexander Graham Bell to Gardiner Hubbard

London 18 Mch 1878[a]

Dear Mr Hubbard,

I am glad that you have taken steps to become interested in the Phonograph for I believe in a great future for it both separately and in connection with the Telephone.[1]

It is a most astonishing thing to me that I could possibly have let this invention slip through my fingers when I consider how my thoughts have been directed to this subject for so many years past. So nearly did I come to the idea that I had stated again & again in my public lectures the fundamental principles of the Phonograph. In showing to an audience the tracings produced by the Phonautograph I had said if the motions indicated by the curves could be produced mechanically in[b] any way the sounds would be audible. For instance I have said in my lectures that if I were to move my hand in the way indicated by these curves articulate sounds would proceed from the hand. And yet in spite of this the thought never occurred to me to indent a substance[c] and from the indentations to reproduce sound.[2] Two French physists[c] Physicists[d] have been working at this subject for a ~~number~~ couple[c] of years past and were much chagrined by Edisons phonograph anticipating their invention[3]

I believe that the phonograph will be enormously improved. I am having made an apparatus that will give still better results ~~over~~ than those produced by Edison. The articulation of those Phonographs we have seen in this country has been imperfect chiefly I think on account of the fact that the motion of the spring is produced only in one direction. It can~~not~~ be pushed up out of a depression but it has to fall into the next depression by its own elasticity & unless the normal rate of vibration is very much slower than the rate of the sound to be produced the shape of one half of the vibration will be distorted.

My idea is to drag a slip of tinfoil rapidly under a vertical style which is caused to press upon the tinfoil with uniform force by means of a weight or spring so that the normal action of the apparatus will be to create a straight furrow or groove[f] of uniform depth and thickness.

A section of this furrow would be rectangular. ~~The~~ A[c] horizontal motion is imparted to the style by a telephone plate and thus the furrow instead of being in a straight line becomes a sinuous line in fact the curves produced by the phonautograph[c] will be produced by this apparatus in an indented form.

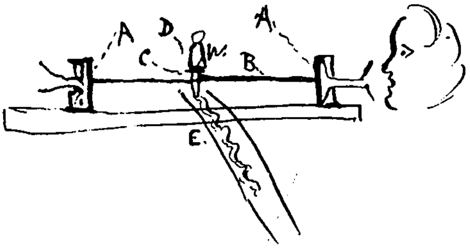
From this tinfoil a cast can be made in some solid material and an impression taken from this cast in copper or lead or other material as in the case of stereotype[c] plates. Let this solid plate of lead or other material be arranged under the style from which the original impressions were taken so that the style fits into the ~~curves~~ groove. ~~t~~The[g] dragging forward of the plate will then[h] occasion a horizontal motion of[c] the style and thus the sounds will be reproduced from the telephone plate

In the case of this form of Phonograph the motion of the ~~sty~~ style[c] is completely controlled and the sounds produced should therefore be a perfect facsimile of the original sounds if the plate is dragged forward at the same rate of speed.

I enclose a drawing of apparatus   Yours very truly[i]

Alexander Graham Bell

P.S. The following rude sketch may give you the idea   Alex



A. Two telephone plates united by[j]
B. a slip of wood bearing
C. the style carrying on its top
D. a weight.
E. Tinfoil.

LS, DLC, AGB. [a]"London" and "187" preprinted. [b]Interlined above. [c]Obscured overwritten letters. [d]Interlined above by Bell; obscured overwritten letters. [e]Interlined above by Bell. [f]"or groove" interlined above by Bell. [g]". T" added by Bell. [h]Added by Bell. [i]Signature, postscript, and sketch by Bell. [j]Connected to "B" by line.

1. Bell's admiration for the phonograph was apparent in his "speech at a large meeting [in London] in behalf of a new school to teach the deaf articulation. He said if Mr Edison could take a piece of iron & make that speak, how much easier should it be for the good teacher to take the vocal engine God had made & bid them talk." Hubbard to TAE, 24 Apr. 1878, DF (*TAEM* 19:60).

2. In another letter from London, probably sent shortly after this, Bell wrote Hubbard:

> There is a question in my mind how far Edison can control the principle of the Phonograph—for I long ago pointed out the very mode of producing sound that he employs. In my public lectures in America I exhibited the tracings obtained by means of the human

> voice and stated that if you could "by any mechanical means" produce a motion similar to that indicated by a sound-curve you would produce the sound itself. I have stated the idea in the most definite terms for instance I have stated in illustration "If I could move my hand in the way in which the air is now moved by my voice articulate words would proceed from my hand. Of course the same result would follow in the case of other materials. For instance if pieces of wood or of iron were moved in the proper manner—articulate sounds could be produced by their motion. Now in the Telephone this is accomplished by moving a plate of iron in the desired manner by subjecting it to a varying attraction from a magnet" &c &c &c.
>
> It seems to me therefore that all that Edison can rightly claim is his apparatus and the mode of making the voice produce a record of its own vibration That can be utilized as a means of reproducing the original vibrations. But the idea of producing the effects of articulate speech by moving a plate of iron or other material in the way in which the air is moved by the voice—is certainly my invention and if that point is not claimed in any of my patents it should have been—for I stated the principle again & again in my public lectures. I say this not to detract from the merits of Mr Edison's invention but to state my opinion that he should not cover too broad a ground—for I have now a new invention suggested to me by the Phonograph which can be turned to immediate account so as probably to realize a large fortune in a couple of months or so. I want your advice in the matter as to whether I should patent my idea. Also whether it would be necessary to pay a royalty to Edison. I give you full power to make any arrangement with him in the matter. Perhaps he might be glad to unite our interests regarding the Phonograph & Telephone and give each other the benefit of our ideas for the phonograph cannot be made a commercial success for a long time to come whereas my idea immediately available.

Bell's idea was a policeman's rattle made by recording "a word such as 'Fire, Fire,'—remove the tinfoil—stereotype the impression—and then cast copies from it to be placed round a wheel as in the rattle." The letter and a transcription are in Box 1103, NjWAT.

Hubbard sent the undated letter to Charles Cheever, who responded:

> Taking the various points into consideration I should not advise Mr Bell's applying for a Patent as suggested, it strikes me the result would be very disagreeable for us and injurious to Mr Bell as well as to our interest in the Phonograph invention.
>
> Mr Bell says that he long ago pointed out the very mode of producing sound that he (Edison) employs stating it could be done by various mechanical means. In that particular sense it certainly was not patentable by Mr Bell, if it was I fear that in the very same train of reasoning Mr Bell's Patents would be considered valueless for want of novelty, or to illustrate the thing differently I consider that if a description such as Mr Bell gave of what might be done by mechanical means in the way of producing articulation were patentable from the description given of it by him, then the various de-

scriptions given in different electrical works in regard to the Telephone would date so much prior the time of Mr Bells actual invention, that is the invention would not be considered as new. [Cheever to Hubbard, 21 May 1878, Box 1205, NjWAT]

3. Bell is probably referring to Léon Scott and Charles Cros. Scott was a stenographer and typesetter interested in making a written record of words as fast as they could be spoken. While attempting to create what he called "natural stenography," Scott conceived a mechanical model of the ear to trace acoustical vibrations on a hard surface, which he called the phonautograph. In the introduction to an 1878 collection of his publications on the phonautograph, *Le problème de la parole s'écrivant elle-meme,* Scott insisted that his earlier inventive work and that of Cros had anticipated the Edison phonograph. He also criticized the phonograph because it did not create an intelligible visual record of human speech. Charbon 1981, 16, 25–26; "The Phonograph," *Engineering,* 8 Mar. 1878, Cat. 1240, item 449, Batchelor (*TAEM* 94:139); Hankins and Silverman 1995, 134–37.

-1261-

Edward Johnson to Gardiner Hubbard

Washn DC 3/18/78

My Dr Sir—

In[a] accordance with promise to keep you advised of the development of the Carbon Telephone of Mr Edison I beg to make the following report

Mr Edison has discovered that it is not by the vibration of the plate that he obtains the variable strength of his currents—but by simpl~~y~~e pressure[a] of the air waves against the outside plate covering the Carbon—¬ He thereupon fastens the plate rigidly against the Carbon cup—removing the Elastic rubber cushion which previously provided for the[a] vibration of the plate & obtains the following remarkable results

1st absolute clearness of articulation

2nd 3 to 4 times the disturbance of his Primary current —hence a proportionate increased strength of current in his Secondary coil—(Main Line)—the practical Effect of which is

A= Longer Lines Traversed
B=[b] Greater volume of sound on receiving Instrument
C.[b] Induction—frying pan noises[1]—overpowered
D. It can be heard (the receiver) when the Inst is held at arms length—the words being clearly distinguishable[c]

3rd Increased simplicity—no adjustment of the Instrument requisite—after the first—

It will convey a whisper many miles It will receive & convey clearly ~~whis~~ words whispered at the Transmitter when 6 feet removed from the mouth—

It will work perfectly satisfactory on the wires of the W.U. Co between Philada and New York.

It has been successfully operated on the wires of the same Co between Pha & Pittsburg (355 miles)

It was tested with apparently satisfactory results upon a loop from Pha to Pgh & return—with a[a] telephone in ckt. at Pgh to ensure its passsage through that city—but I do not consider a loop test of any practical value no matter how carefully made

It certainly works O.K. between Pha & Pgh[2] [—][d] Very Respy Yours

E H Johnson

ALS, NjWAT, Box 1198. Letterhead of Bell Telephone Co. [a]Obscured overwritten letters. [b]Following sentence enclosed by brace. [c]"D. . . . distinguishable" interlined to side of list and line drawn around it; horizontal centered line under "clearly distinguishable." [d]Canceled.

1. Edison and his coexperimenters had described line noise this way for some time; see, for example, Doc. 963.

2. On 23 March, Hubbard went "to see Mr Edison in regard to his new Telephone, to ascertain if we could secure it to the Bell Telephone Co." He then told Thomas Sanders, the Bell Telephone Co. treasurer, "I think it is an infringement on our Patents, but that it may also be a very valuable improvement what does Mr [Thomas] Watson think of it. Please ask him to write his views about it fully." Hubbard to Sanders, 25 Mar. 1878, Box 1193, NjWAT.

-1262-

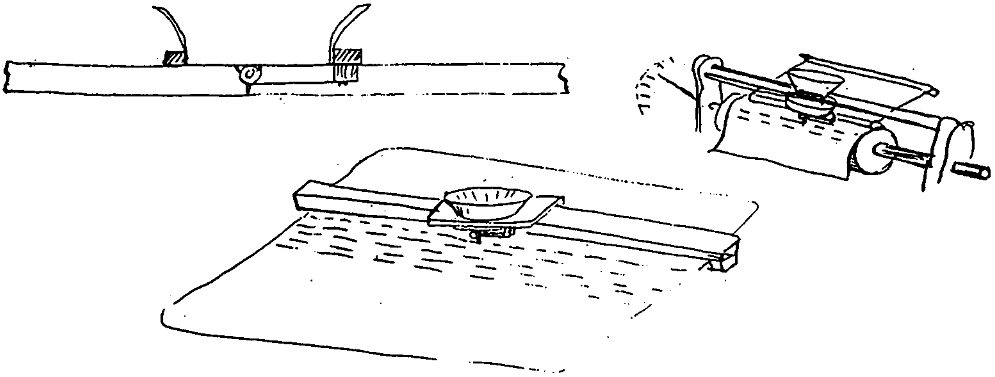
To Alfred Mayer

Menlo Park N.J. Mch 20= 78

Friend Mayer

The idea is good if you will work out a device to reciprocate the diaphgm back and forward by hand but governed to give an even speed and forward feed. I will put it in the Phonograph Co for you on a royalty.

For a diaphragm this would be better.



All that is requsite to carry your idea out is a reciprocating device with a governor, the whole working by hand power[1a]

I am making a large machine with a reciprocating lever worked by powerful clockwork using a continuous roll,[2] but this is for lecture purposes & would be to expensive for the blind who would require something[b] very cheap and easily managed= Will you have time to work it out=[3] Barker writes that your phono article will not appear in the April ~~HP~~ Scienc Monthly= ~~How~~ Is that so & if so how did he find it out.[4] You ought to hear My Telephone now its perfect. Struck the best thing yet I use no vibrating diaphragm Nothing Vibrates the sound waves are transmitted ~~directly~~ into electric waves without the movement of any intervening mechanism

My assistant sailed for England this morning to give a big test on P[ost] O[ffice] Telegraph as Bells has been abandoned as impracticable on their noisy lines Yours

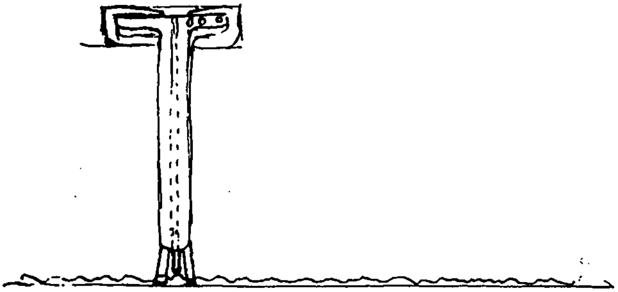
Edison

ALS, NjP, Hyatt & Mayer. [a]Followed by "over" to indicate page turn. [b]"thing" interlined above.

1. On 17 March, Mayer had written Edison about his idea for recording books for the blind on metal sheets, providing the following description and drawing:

> Guides on a frame, can readily be placed over the lines of impressions and then a style with a vibrating plate attached can be run over the lines by the blind person and the page will talk to him. This represents the style and plate running over the elevations and depressions in the electrotyped or cast pagê. [DF (*TAEM* 18:948)]

Alfred Mayer's sketch of the hand unit in his plan for recorded books for the blind.



2. For Edison's clockwork design see Doc. 1310. Edison's 28 February phonograph caveat shows several designs for recording on continuous rolls by use of a reciprocating lever indenting in a transverse groove across the face of the paper or foil (Doc. 1227 [figs. 44, 45, 54, 59, 60, 61, 62, and 64]). He first conceived such a design in connection with his telegraph recorder/repeater in 1877 (see Doc. 947).

3. Although Mayer responded the following day that he was "en-

couraged to go on" by Edison's letter, there is no evidence of further work on this idea. DF (*TAEM* 97:645).

4. Barker's letter to Edison is Doc. 1254. Mayer replied on 21 March that the article, "On Edison's Talking Machine" (Mayer 1878a), had already appeared in the April issue and opined that Barker "had better experiment more and talk less." DF (*TAEM* 97:645).

-1263-

From J. W. S. Arnold

[New York,] March 20th 1878

My dear Sir

Enclosed please find tickets to the lecture for Saturday evening.[1] I shall be happy to have you occupy a seat upon the stage, and will take great pleasure in presenting you to the audience. Very Truly Yours

J W S Arnold[2]

⟨Friend Arnold= point received many thanks. I wouldnt face an audience for 100 dollars the reporters that come down here have already unstrung my nerves that I think of taking to the woods Yours Edison⟩

ALS, NjWOE, DF (*TAEM* 97:644).

1. Arnold had written Edison on 2 March about his benefit lecture on the "Voice and the Ear" for the New York Ear Dispensary and asked for the use of a phonograph as well as Edison's presence at the lecture (DF [*TAEM* 18:932]; see also "Explaining the Phonograph," *New York Tribune*, 20 Mar. 1878, Cat. 1240, item 429 [*TAEM* 94:130]). The lecture took place on 23 March at Chickering Hall where Arnold exhibited one of Edison's small phonographs; he was apparently unsuccessful in acquiring the larger phonograph he had asked Edison for on 7 March (DF [*TAEM* 15:8]). An account of the lecture accompanied by Arnold's text and illustrations of the phonograph, appeared in the 25 March issue of the *New York Tribune* ("The Phonograph," Cat. 1240, item 455, Batchelor [*TAEM* 94:143]). The "conversational" and "singing" telephones Arnold used in his lecture were probably Edison's carbon-transmitter (his "speaking" telephone) and electromotograph receiver (his "musical" telephone).

2. According to the *New York Tribune* article about his lecture (see note 1), Arnold was a professor at the University of the City of New York (later New York University); Wilson 1878 (p. 46) identifies John W. S. Arnold as a physician.

-1264-

Exhibitor's Form: Paris Universal Exposition

Menlo Park[a] [c. March 20, 1878][1]

Universal Exposition of 1878, at Paris.

Information for Jury, to Accompany Each Exhibit.

Exhibitors must immediately answer the following questions, as far as possible, and forward the blank to R. C. McCormick, U.S. Commissioner General, Room No. 24, Post Office Building, New York City.

1.—Nature of the Exhibit.
Electrical Acoustic and other apparatus
2.—Number of Application.
3.—Where produced or manufactured.
Menlo Park New Jersey U.S.A
4.—Extent and capacity of works.
Laboratory. 28 by 100 2 Stories= gGoods manufactured in various workshops, & countries
5.—Kind and quantity of power used.
6 horse power
6.—Number of persons employed: Men, ~~Women, Children~~,[b]
8 assistants[2]
7.—Extent and value of the annual production.
In excess of One hundred thousand dollars
8.—Business, when commenced.
1869.
9.—Markets, and place of consumption.
In all parts of the world.
10.—Sources of materials used.
Air Earth and Sea.
11.—Peculiarities of the object shown, or of the manufacture. State all considerations relating to invention, discovery, utility, quality, skill, workmanship, fitness for purpose intended, adaptation to public wants, economy and cost.
This is an inventor's and not a manufacturers exhibit, and too extensive to attempt detailed information in this limited space.[3]
12.—Special or particular claim of merit to which the exhibitor desired to call the attention of the Jury.
Originality and usefulness.
13.—What prizes have been awarded to the exhibitor at previous International Exhibitions.
For the Electric Pen—Quadruplex, and Auttomatic Telegraph Systems—Philadelphia
14.—State what special provision has been made, if any, for the promotion of the health, morals and education of the workmen.
Elevated Location, and excessive ventilation
15.—Give signature in full of the applicant for space, with place of business and date; state also Agent's name and address.

Agent in Paris, Geo L Beetle, 9 Rue de la Bourse
Name in full, Thomas Alva Edison Post Office address, Menlo Park New Jersey U.S.A.

ADS, NjWOE, DF (*TAEM* 18:401). Heading, questions, "Agent in Paris," "Name in Full," and "Post office address," preprinted; form number and instructions on back of form not transcribed. Questions and Edison's answers originally in table headed "QUESTIONS" and "ANSWERS." [a]Place from text. [b]"Men, Women, Children," on three lines enclosed in brace; "Women, Children" canceled by Edison.

1. Richard McCormick sent a printed letter, dated 9 March, indicating that "exhibitors who have not filled up and returned to this office form No. 4, 'Information for the Jury,' should do so as soon as possible." He urged those who had not yet received a form to write him as soon as possible. On 15 March, Edison wrote to tell McCormick that he had not yet received it. Presuming that McCormick sent the form immediately upon receipt of Edison's letter, it is likely that Edison filled out and returned it within a few days. "Circular to Exhibitors. No. 8," 9 Mar. 1878, DF (*TAEM* 97:633); TAE to McCormick, 15 Mar. 1878, Lbk. 1:437 (*TAEM* 28:296).

2. Edison was apparently referring only to his machinists and not to his experimenters or office staff. The 20 March *New York World* reported that he employed eight men, "and these the most expert machinists—Swiss workmen all of them." "A Wonderful Machine That Will Be of Immense Value For Various Purposes," Cat. 1240, item 435, Batchelor (*TAEM* 94:131); see also Chapter 1 and 2 introductions, pp. 3 and 132, and Doc. 1302.

3. However, the instructions on the back of the form indicated that "If the spaces opposite each question are not adequate, the answers can be written on separate sheets of paper, attached and numbered to correspond." DF (*TAEM* 18:400).

-1265-

To George Nottage

Menlo Park N.J. March 23 1878—

Dear Sir.

Your letter received, the contracts signed, money paid,[1] my solicitor is now preparing papers for a new phonograph patent in England,[2] one of my assistants will have arrived with two small phonos ere you receive this.[3] The lowest bid I can get is $6.00 each with box in lots of 100. or more; I have a machine here like that of Mr Puskas that talks just as clear as an elocutionist I have 8 men working on the plate machine; This machine requires time because it must be a practical, marketable machine to do the work that is expected of it, and be simple and easily made and one that will be hard to improve, otherwise we will be changing and improving all the time which lessens profits.[4] This machine can only be built on the American principle of interchangeability of parts like a gun or a sewing machine;[5] Hand made machines would create endless confusion— I will send you the 2nd plate machine made and just as soon as the Ansonia Clock Co can furnish a clock I will send that. They have 8 men experimenting their only difficulty is to cheapen the movement. one penny is a large item on a Yankee clock.[6] They are now making a machine to stamp the records out from an electrotype coated with steel I have not heard as yet if it is finished=[7]

The Toy Co have also several men at work experimenting just as soon as I can get hold of one of their toys I will send= They have models working, but cheap production of numbers is the only draw back= The first small phono sent was not good—[8] I think we can get along in business matters all right. I will do the best I can to further the interests of all concerned and endeavor to bring the phono to absolute perfection. I never had but one photo taken and I have lost that— I will however get another and send you=[9] Yours Truly

Thos A Edison

P.S. Please take a fatherly care of our patents as you are near and I am far away. E

ALS (letterpress copy), NjWOE, Lbk. 1:463 (*TAEM* 28:313).

1. On 7 March, Nottage had written Edison, "I have at last settled the agreement with Mr. Puskass relating to the Phonograph and the agreement is transmitted by this mail for your signature, with the sum of £1500 (Fifteen hundred pounds) to be handed to you by the Bank of New York on the due execution of the Deeds." Edison turned a third of the money (minus expenses due) over to Lemuel Serrell for Puskas's account. Nottage to TAE, 7 Mar. 1878, DF (*TAEM* 19:215); agreements with Nottage and George Kennard, 22 Mar. 1878, Miller (*TAEM* 28:1080, 1086); TAE to Puskas and TAE to Serrell, both 22 Mar. 1878, Lbk. 1:457–58 (*TAEM* 28:307–8); see also Doc. 1237.

2. In his letter of 7 March (see note 1), Nottage had written: "I consider it most important that if you have made any essential improvements—as I gather from your Telegram to Mr. Puskass, you have—that you should at once Patent them in this Country, so that if the Original Patent should be upset these would stand. This is very necessary to our mutual success." Puskas made the same point in Doc. 1248, although that letter had not yet reached Edison when he wrote this. Edison's response refers to preparations already in progress before this problem became evident (see Doc. 1237 n. 11).

3. James Adams, who had departed for England a few days earlier.

4. In his 7 March letter (see note 1), Nottage told Edison that "it is most important that you should send me as early as possible, one or two of the plate machines, in order that our representatives may take orders for them, while the Excitement of the Novelty is commencing."

5. On the American system of interchangeable parts see Rosenberg 1969, Mayr and Post 1981, and Hounshell 1984.

6. Most American clocks, apart from decorative cases, cost less than two dollars to make, far less than those made in England. Landes 1983, 310–13.

7. Nothing more is known about this machine.

8. See Doc. 1259.

9. Nottage had sent his own portrait with his 7 March letter (see note 1) and asked for one of Edison. Other than pictures from his childhood and youth, two undated photographs survive showing Edison in his mid to late twenties. *TAEB* 1:5, 27, and frontispiece; 2:frontispiece; Frost 1969, 18, 24, 26–27.

EDISON AND THE PRESS Doc. 1266

Although Edison had begun to receive increasing press attention following the invention of the phonograph, it was not until the end of March that frequent reports and interviews began to appear in the New York press. As Charles Cheever of the Edison Speaking Phonograph Company reported on 15 March, "Newspaper men are wild over it Harpers Weekly—Graphic and Scientific American are all getting large and expensive cuts out at their own expense, in fact the tide has started itself so fast that I have been unable in spite of all that I can do to hold it back until we had the small Phonograph ready to sell."[1] This growing interest was spurred by phonograph exhibitions in New York City and by the appearance of articles on the phonograph in *Popular Science Monthly* and *Scribner's* earlier in the month.[2] Some of the articles that began to appear in the New York papers, especially those by William Croffut of the *Graphic* and Amos Cummings of the *Sun,* were reprinted in the United States and Europe.[3]

Edison was quite willing to accommodate the press and to use them in promoting himself and his inventions. As a former press-wire operator, he was familiar with newspaper practices and made friends with reporters and editors. Some of the operators whom Edison had known during his years as an operator subsequently became reporters. Edwin Fox, for example, was a reporter for the *New York Herald* who began writing articles about his friend in 1878.[4] Others were Thomas Maguire, a reporter for the *Boston Globe,* and James Heenan, of the National Associated Press.[5] Other reporters, Croffut and Cummings in particular, became friends with Edison as a result of their reporting of his activities.[6]

1. Cheever to Gardiner Hubbard, 15 Mar. 1878, Box 1205, NjWAT. Illustrated articles appeared in the 15 March *New York Daily Graphic*

("Singing and Talking by Machinery") and in the 30 March issues of *Frank Leslie's Illustrated Newspaper* ("The Latest Scientific Wonder"), *Harper's Weekly* ("The Phonograph"), and *Scientific American* ("The Phonograph") (Cat. 1240, items 403, 428, 436, 439, Batchelor [*TAEM* 94:123, 129, 132, 136]).

2. Mayer 1878a and Prescott 1878a. On the Edison Speaking Phonograph Co. exhibitions see Doc. 1246 n. 4 and "Explaining the Phonograph" in the 21 March *New York Tribune* (Cat. 1240, item 431, Batchelor [*TAEM* 94:130]). Dr. J. W. S. Arnold also exhibited the phonograph during his lecture at Chickering Hall on 23 March (see Doc. 1263).

3. Articles can be found in Cats. 1029 and 1031, Scraps. (*TAEM* 25:161; 27:732) and Cat. 1240, Batchelor (*TAEM* 94:1); correspondence with reporters can be found in "Edison, T. A.—Articles," 78-005, DF (*TAEM* 17:1). The tenor of many of these articles is evident from the following sample of headlines: "The Napoleon of Science" (*New York Sun*), "That Wonderful Edison" (*New York World*), "The Wizard of Menlo Park" (*New York Daily Graphic*), "A Wonderful Genius" (*Boston Herald*), and "The Inventor of the Age" (*New York Sun*).

4. "Four Hours with Edison," *New York Sun*, 29 Aug. 1878, Cat. 1240, item 859, Batchelor (*TAEM* 94:339).

5. Maguire to TAE, 17 Mar. 1878, DF (*TAEM* 17:26); Doc. 1324 n. 8.

6. On Edison's relationships with various reporters, see his correspondence with them in *TAEM-G1–3*, s.vv. "Croffut, William," "Cummings, Amos," "Fox, Edwin," and "Maguire, Thomas."

-1266-

From William Applebaugh

New York, March 23d 1878[a]

Dear Edison.

Mr W. A. Croffut[1] one of the enthusiastic editors of the "N.Y. Graphic" and by the way a good friend of yours, though unknown to you personally, desires to visit your laboratory some day next week—[2] If agreeable will you kindly indicate two or three days when you expect to be home so that he can take his choice?— In case you find that you will not be there on any one of the fixed days please telegraph me— Mr Croffut has written an article which will appear in todays Graphic on the "Airophone"[3] I dont know from whom he got his points— The Graphic people have treated your inventions very squarely & I hope you will be able to give Mr Croffut an interview Yours truly

Ap——[b]

ALS, NjWOE, DF (*TAEM* 17:31). Letterhead of the Telephone Company of New York. [a]"New York," and "18" preprinted. [b]"'Boston To Ap—N.Y. Pls send some business on 28 Martin 'or Wright'" written by Applebaugh on side of letter.

1. William Croffut (1835–1915) was an established newspaper writer and editor at this time. He had reported on the Civil War for the *New York Tribune* and later worked for the *New York World* as well as the *New York Daily Graphic.* Obituary, *New York Times,* 2 August 1915, 9.

2. Croffut visited the laboratory and published an account of the visit in the 2 April *Daily Graphic* (Doc. 1277).

3. This article, titled "The New Speaking Machine" (p. 157), described the aerophone as "in fact, a phonograph with its power tremendously increased." In it Croffut reported some of the uses Edison thought the device might have, such as in railroad locomotives and lighthouses, then observed that it could prove annoying if applied, for example, to political campaign speeches. He ended the article with the whimsical observation, "What an instrument of slander will the aerophone be in the hands of the malicious! It occurs to us, by the way that this Mr. Edison has done enough, and ought not to be allowed to prosecute his diabolical inventions any further. His brain ought to be muzzled. Will the Sheriff of Menlo Park please to restrain him?"

-1267-

To Benjamin Butler

Menlo Park NJ Mch 25 78

Friend Butler.[1]

I find I cannot get away= Every day a dozen of the heavy lights of literature and science come here; I wish when you go to NY again that you could manage to stop off here one train. Dana[2] of the Sun comes wednesday: Yours

Thos A Edison

ALS, DLC, Butler.

1. The controversial congressman, lawyer, and former general Benjamin Butler had been one of the attorneys for Jay Gould's Atlantic and Pacific Telegraph Co. in its suit against Western Union over control of the patent rights to Edison's quadruplex telegraph designs. In previous years he had appeared on Edison's behalf in related actions. See *TAEB* 2:374, 491, 806.

2. Charles Dana had been owner-editor of the *New York Sun* since 1868 (*DAB,* s.v. "Dana, Charles Anderson"). On 23 March, *Sun* reporter Amos Cummings had written Edison:

> I find that Mr. Dana is at length satisfied that I have not been imposed on. He has read Scribner's and the Science Monthly, and astonished me on Wednesday by saying that they backed me up "in every word." He won't come to hear my machine nor go into the Tribune and as he wants to see it and know more about it I have invited him and J. S. Pike, late U.S. Minister to the Hague, to come with me and see you on Wednesday next. If I am trespassing on your time or annoying you by the visit, say so and it's all right. You will find Pike and D. two as sensible old blokes as you ever struck—no frills nor flounces. [DF (*TAEM* 17:30)]

-1268-

To Theodore Puskas

[Menlo Park,] Mch 25—78[1]

In haste

Friend Puskas,

We are hurrying the plate machine—but you know that the plate machine must be perfect before it can go on the market= got contract from you & closed the matter= I will take out additional patent in England please keep me informed about any necessary steps that must be taken with patents in France Germany etc= ⅓ of funds obtained from Nottage I gave to Serrell for your account He is drawing up a contract between me and you giving you ⅓ of the English royalty with one or two provisions which I think you will think favorable of=[2] Do what you can about seeing that the English patent is well advised on— Please get permit for entering my goods in Exhibition should I be delayed beyond 1st May= I send you lot of Journals to London the excitement over phono is great here[a]= Telephones that Adams has although about perfect have been greatly improved since he left In fact the Carbon telephone is going to be one of the greatest successes in that line notwithstanding we have heretofore had hard luck with it= You cannot fail to sell it to every government for general telegraphing where the Bell telephone is conceeded to be a failure Use Adams' if you think best= I send some perfect telephones in few days.= The cases are of cast iron, ~~which~~ the rubber cases have enormous expansion with heat & cold & this has been the source of great trouble= I thank you very much for your success before the french academy— Yours

Edison

ALS, HuBPo, TP. [a]Obscured overwritten letter.

1. This is in part a reply to Doc. 1248, which would have just arrived.
2. This is the 16 April agreement, which also gave Puskas power of attorney in regards to the phonograph in Britain (TP).

-1269-

Draft Caveat: Telephony

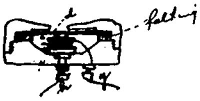
[Menlo Park, c. March 25, 1878?][1]

Telephone Caveat[a]

The object of this invention is to improve the apparatus for telephonic transmission of oral communication over telegraphic circuits.

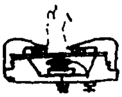
The invention consists in various devices for increasing the volume of sound, for cheapening the apparatus, ~~and~~ [-][b]

Fig 1[2]



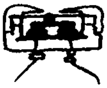
In figure .1. is shewn a transmitter similar to that shewn in previous caveats, ~~w~~ except that the diaphragm does not vibrate, at least to an extent as to be evidenced by the senses. b is a glass disc resting upon a platina disc connected by a conducting wire to the binding post .g. a is the lampblack button. c is a platinized adjusting pillar connecting ~~to the bi~~ by a wire[3] to the binding post .h. When properly adjusted the diaphragm, carbon & metallic discs are in contact. The sound impulses striking upon the diaphragm increase the pressure upon the carbon and the effect is to lesson the resistence in proportion to ~~its~~ the[c] pressure hence the primary circuit of an induction coil is ~~increased~~ decreased in resistance by the impact of every soundwave and the secondary coil receives induced currents which are transmitted over the wire & act upon the distant receiver

Fig 3



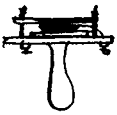
In fig ~~2~~ 3. Rubber dampers are placed between the inner edge of the mouthpiece to ch~~a~~eck any rebound of the diaphragm which sometimes takes place by loud talking when the instrument is not properly adjusted=

Fig 2



In fig 2 is shewn double carbons the current passing through both, with this the volume of sound is somewhat increased.

Fig 4



In fig .4. The resonant chamber is dispensed with and the diaphragm is laid directly upon the carbon being held in place by 3 pins provided with spiral springs to keep the diaphragm down—

Fig 5

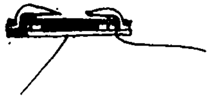
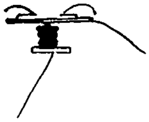


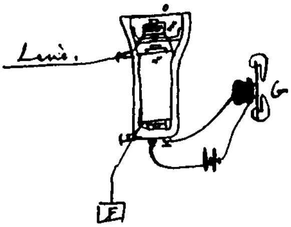
fig 6



in fig 5 a very large disk of carbon is used

In fig .6. several carbons are used seperated from each other by platina faced j metallic discs—

Fig 7



In fig .7. The induction coil is arranged in the same case as the receiver the poles of the receiver magnet .m. being in close proximity to the core of the induction coil. G is the carbon transmitter. of course the magnet M might be dispensed with and the diaphragm .O. be worked direct by the induction coil core

Fig 8

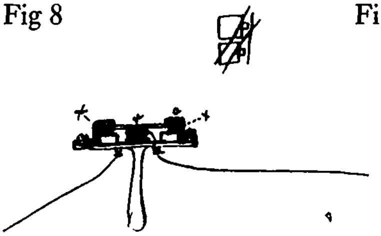
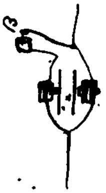


Fig 9



In fig .8. the diaphragm n^c is laid upon a ring of felt or rubber—

In fig .9. is shewn a receiver 1 & 2 are diaphragms[4] in front of which are electromagnets B is a battery which determines the effect of the incoming current on either one magnet or the other

Fig 10

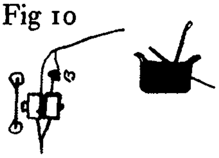


Fig 11

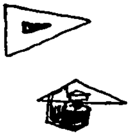


Fig 12

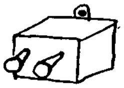


fig 10 shews the two magnets arranged with the battery B to produce the same effect.

Fig 11 shews a prismatic diaphragm

fig 12 shews a box containing both the transmitter & receiver with funnels extending outside.

Fig 13

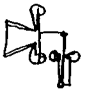
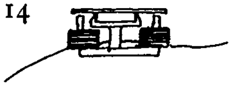


Fig 14

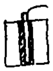


Receiver=

fig 13 shews a diaphragm connected by a wire to an ordinary polarized relay—

fig 14 shows a diaphragm fastened near its center and the poles of the magnets acting upon its edge.

Fig ~~7~~15



Telephone battery Hyperoxide of manganese and Lampblack pure, pressed in mould under great pressure= Sal Am outside=[5]

fig 15 shews a battery especially designed for telephone work consisting of a cylinder of Hyperoxide of ~~manganese~~ lead formed by hydraulic pressure and immersed in a solution of sal. ammoniac with Zinc;[6]

fig 15[7]

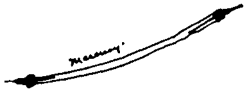


fig 15 shews a flexible conductor for telephones consisting of rubber tubing with iron wire terminals & the tube being filled with mercury=

ADf, NjWOE, Lab., NS-Undated-006 (*TAEM* 162:706). All figures appear on a single page. [a]Heading taken from page of figures. [b]Canceled. [c]Interlined above.

1. Edison probably began this draft soon after the successful design changes and tests of his telephone on 12 and 13 March 1878. The page of figures appears to have been drawn before the text was composed; thus, the differing lists of battery materials in the text of the caveat and in the description on the page of figures (see fig. 15).

2. Figure labels are (clockwise) "d," "felting," "g," "h," "c," "a," and "b." An illustration in Plush 1878 (p. 269) shows (on a larger scale) the same electro-mechanical design in an instrument with a handle (see headnote p. 173).

3. Not shown.

4. At center.

5. This paragraph accompanied the figure in the original.

6. It is not clear whether this is the battery design mentioned by Edison in Doc. 1241.

7. Text is "mercury."

-1270- Washington, D.C., Mar. 26, 1878[a]

Notification of Patent Interference

Interference A.[1]

Thos. A. Edison[2]

Please find below a copy of a communication from the Examiner concerning your[b] application for patent for Speaking Telegraph (Case 130) filed Apr. 27 1877.[3] Very respectfully,

Ellis Spear.[4] Commissioner of Patents.[c]

Your case above referred to is adjudged to interfere with the applications and patents named below— and the question of priority will be determined in conformity with the rules accompanying this.[5] The preliminary statement demanded by Rule 53 must be sealed up and filed on or before the 6th day of May, 1878,[6] with the subject of the invention and name of party filing it indorsed on the envelope. The subject=matter involved in the interference is[d]— "The herein before described art of transmitting & reproducing at a distance sonorous waves or vibrations of any description which consists in increasing & decreasing the strength of an electric current traversing a circuit in such a manner as to produce in said circuit a series of electrical waves or vibrations precisely corresponding in their intervals of succession and relative amplitudes to the sonorous waves which are to be reproduced at the receiving station or stations so that oral conversations or sounds of any description whatever may be telegraphically transmitted."[7] (Gray's 1st claim)[e]

This is substantially the method specified in Bell's 5th claim[8] and is described in the applications of Edison, Berliner, Richmond, Dolbear and Holcombe.

Parties to Interference.[9]

Elisha Gray. App'[licatio]n filed Oct. 29th 1877 (No 1)[10] Attys of record, Baldwin, Hopkins and Peyton,[11] Washington, D.C.

Emile Berliner.[12] App'n filed June 4th 1877.[13] Atty of record, James L. Norris,[14] Washington, D.C.

George B. Richmond.[15] App'n filed Aug. 24, 1877, Atty of record, George W. Dyer,[16] Washington, D.C.

A. E. Dolbear.[17] Appn filed Oct. 31, 1877. (A) Attys of record Frank L. Pope, Elizabeth, N.J. James L. Norris, (Asso. Atty)[f] Washn. D.C.

A. G. Holcombe.[18] Appn filed Jan. 28th 1878, Atty of record, Moses G. Farmer,[19] Torpedo Station, Newport, R.I.

A. G. Bell. Patent No. 174,465. dated Mar. 7th, 1876.[20] Atty of record, A. Pollok,[21] Washington, D.C.

H. C. Townsend Ex'r[22]

ADS (copy), MdSuFR, U.S. Pat. File 474,230. U.S. Patent Office interference form; dockets, codes, and room number omitted; a transcription is in TI 2:6–7 (*TAEM* 11:187). [a]"Washington, D.C.," and "187" preprinted. [b]"Please . . . your" preprinted. [c]"Very respectfully," and "Commissioner of Patents." preprinted. [d]Paragraph preprinted to here except for "the . . . below—", "6th", "May", and second "8" in year. [e]"(Gray's 1st claim)" interlined above. [f]"(Asso. Atty)" interlined above.

1. This notification constituted part of the official initiation of an extensive set of patent interferences (quasi-judicial proceedings in the Patent Office) to sort out Edison's and others' rights to various telephone designs (on interferences in the context of the U.S. patent system, see *TAEB* 1, App. 3; Israel and Rosenberg 1991). Faced with several inventors seeking patents for all or some aspects of telephone technology, the patent office examiners declared a set of thirteen interferences on this date, each on a separate feature or on a small number of closely related ones (see note 7). The initial set of interferences included Edison and the six persons listed below, some of whom later were fully or partly dropped while others were added and the issues somewhat reconstrued. In "Speaking Telephone Interferences: Decisions of the Examiners-in-Chief" (TI 5 [*TAEM* 11:891]), the original contestants were said to be fourteen in number, but that many have not been identified. More declarations followed, different interferences involved different antagonists, and no one individual, including Edison, Alexander Graham Bell, and Elisha Gray, the primary claimants to fundamental telephone patents, figured in all of them.

The first thirteen interferences were designated by letters A through M (headings on some records refer to A through N but no other records of N have been found). Others of which Edison retained records were Interferences 1 through 6, Interference B^3, and Edison v. Dolbear v. Anders (TI 6–8 [*TAEM* 11:919, 977, 1019]). Although not declared until 14 August 1879, Interferences 1 through 6 also involved earlier inventive work and the depositions, exhibits, and arguments regarding them significantly overlapped those for the initial set of telephone interferences; No. 1 was combined procedurally with the earlier set. Almost all of the decisions on the initial set of interferences were appealed within the Patent Office and the consequent rulings were announced on 23 October 1884, but that by no means settled all the disputes (some of the patents involved did not issue until the 1890s; see notes 3 and 13).

Printed records of all these cases constitute the materials designated "TI" and "Telephone Interferences" in *TAEM* and *TAEB;* the portions directly related to Edison's involvement in the proceedings are on *TAEM* 11, passim. The document file at the Edison National Historic Site for the years involved also includes considerable related correspondence. During 1880, Edison's laboratory and workshop records were examined, categorized, and rearranged as documentary evidence was prepared for use as exhibits (see *TAEB* 3:19–20). Further material exists in the application files for the various patents involved and in the collections of papers and artifacts of Bell and Gray.

2. This was sent to Edison in care of his patent attorney Lemuel Serrell and a marginal note indicates that a copy was sent to Western Union, the assignee of the patent.

3. Case 130 eventuated in U.S. Patent 474,230, issued on 3 May

1892. It was the earliest application for a variable-resistance telephone transmitter in which a diaphragm pressed against carbon. The patent drawing is reproduced in *TAEB* 3:254; a transcription of the original application and a copy of the drawing are in TI 2:2–5, 13 (*TAEM* 11:185–86, 190). Case 130 was also involved in Interference B.

Four of Edison's other applications were caught up in this first set of telephone interferences, namely Cases 141 (executed 9 July 1877, involved in Interferences M and 1), 144 (31 August 1877, C and D), 145 (13 December 1877, L and E), and 148 (24 December 1877, G and J). The patents that eventually emerged were 474,231 and 474,232 (both from Case 141, issued 3 May 1892) and 492,789 (Case 144, issued 7 March 1893). Neither Case 145 nor 148 (which actually concerned a design for acoustic telegraphy but which included features relevant to telephony) resulted in a patent; for transcriptions of the applications see TI 2:25–30 (*TAEM* 11:198–202).

Further applications (Cases 158 and 178) were dealt with in other, later telephone interferences. See TI 6 and 7 (*TAEM* 11:919, 977).

4. Commissioner from January 1877 to November 1878. *NCAB* 13:364.

5. No copy of the U.S. Patent Office *Rules of Practice* remains with the original. A copy of the 1875 edition is in Quad. 72.15; the section dealing with interferences is on pages 15–19 (*TAEM* 9:228–30).

6. A preliminary statement was a sworn affirmation stating when the inventor claimed to have accomplished the point in question and what kinds of evidence would be presented to support that assertion. Attorneys for opposing parties regularly sought to use such claims as final limits on what evidence could be introduced and what questions could be raised throughout the rest of the proceedings. The due date for these statements was changed and Edison did not officially attest to his preliminary statements on these interferences until 25 September 1878. They were filed three days later. TI 1:ix–xxi (*TAEM* 11:14–20).

7. Similar statements concerning the claim(s) in question were provided for each of the other interferences. TI 1:ii–vi½ (*TAEM* 11:10–12).

8. This read: "The method of, and apparatus for, transmitting vocal or other sounds telegraphically, as herein described, by causing electrical undulations, similar in form to the vibrations of the air accompanying the said vocal or other sounds, substantially as set forth." See note 20.

9. This interference was expanded to include claims by two more inventors, W. L. Voelkers and J. W. McDonough, and it was linked with Interference No. 1, which involved John Irwin, Francis Blake, Jr., Edison, and Voelkers.

10. Four applications by Gray were at issue in the initial set of telephone interferences, three from this date and one from 17 January 1878. Whether any part of these eventuated in an issued patent has not been determined. Gray's deposition and supporting evidence are in TI 3:289–434, NjWOE; transcriptions of the applications are at TI 3:289, 307, 319, and 333. For Gray's inventive work and claims regarding telephony see also Doc. 1212 n. 13; Prescott 1878c, 151–217; Gray 1977; Hounshell 1975; Gorman et al. 1993.

11. Otherwise unidentified.

12. Emile Berliner had immigrated to the United States from his

native Hanover (recently annexed by Prussia) in 1870. His principal inventive work to this point involved telephone-transmitter and microphone designs (*DAB*, s.v. "Berliner, Emile"; Wile 1974). On 3 September 1880 all claims he had in this and other general interferences were dismissed, but Interference M, with Edison, and his patent application remained pending (TI 1:ii [*TAEM* 11:10]).

13. Berliner's telephone-transmitter application eventuated in U.S. Patent 463,569, issued on 17 November 1891. The text of the April 1877 caveat upon which it was based is transcribed in Wile 1974, 309–13. The patent drawing is shown in King 1962b, 325.

14. Unidentified beyond his association with Dolbear and Pope shown below.

15. George Richmond had developed a variable-resistance telephone transmitter employing water (Doc. 1021; *TAEB* 3:517 n. 2). On 1 May 1879 his claims were dismissed from this and all but one of the other interferences. He submitted no evidence or argument to support that case. (TI 1:ii [*TAEM* 11:10]). No copy of Richmond's application has been located.

16. In January 1880, Washington, D.C., patent attorneys George Dyer and Zenas Wilber took charge of Edison's new U.S. patent applications. Lemuel Serrell continued to act for him in regard to prior U.S. applications and interferences and foreign patents. The firm dissolved in February 1882, at which time Edison transferred all of his new patent business to the firm of Richard Dyer (George's son) and Henry Seely, with Dyer acting as his principal attorney. George Dyer and Serrell continued to act on Edison's behalf in regard to some of his older cases. See *TAEM-G2*, s.vv. "Dyer, George W.," "Dyer, Richard N.," "Dyer & Seely," and "Wilber, Zenas Fisk."

17. Dolbear was professor of physics and astronomy at Tufts University in Boston. He had an agreement with Gold and Stock Telegraph Co. that gave him funding and the assistance of Franklin Pope, as patent solicitor, to prepare, file, and argue for a patent application on his claimed invention, and gave Gold and Stock (and thus Western Union) ownership of any resulting patent; *BDAS*, s.v. "Dolbear, Amos Emerson"; Dolbear's deposition, p. 9, Telephone Interferences; Dolbear's application and supporting deposition are in TI 3:435–70, NjWOE.

18. Holcombe (otherwise unidentified) was dismissed from the interferences on 29 July 1879 (TI 1:ii [*TAEM* 11:10]). No copy of Holcombe's application has been found.

19. The prominent inventor Moses Farmer was electrician at the U.S. Torpedo Station in Newport, R. I. See *TAEB* 1:68 n. 8; on the role of inventors as patent attorneys see *TAEB* 1, App. 3.

20. This was Bell's patent for the use of "undulating current" in telegraphy, which emerged through judicial and business decisions as the key patent for all telephony. It is printed in Prescott 1878c, 205–15.

21. Anthony Pollok was a partner in one of the leading law firms dealing with patents in Washington, D.C., patent attorney for Bell and Gardiner Hubbard, and a longtime advisor to Hubbard. Bruce 1973, 130, 138, 161.

22. Henry Townsend, first assistant patent examiner, was apparently also a friend of Edison's, cf. TAE to Townsend, 26 Feb. 1878; Townsend to TAE, 16 and 28 May 1878; all DF (*TAEM* 18:1000, 15:285, 715).

-1271-

To Theodore Puskas

M Park NJ Mch 28= 78

Friend Puskas

A gentleman named Bailey representing what he calls Grays Telephone interest will call on you with a short letter from me=[1] I had to give him the letter to get rid of him= from all I can learn Gray has no patent interest or claims whatsoever in foreign countries on Speaking Telegraphs although he probably[a] has on Musical Telephones; Bailey claims that the there[a] is things in his foreign patents that[a] covers Bells telephone= I dont believe a word of it= Our telephone is free from any claims he can bring up and will work on Government telegraphs where neither Gray nor Bells will work= please do not mention that I wrote you this[a] letter or that you have heard from me in regard to the ~~Bell Telep~~ Gray Telephone's=

Phono= Plate machine most finished will test in few days will telegraph if perfect Your people must not get excited if plate machine is slow coming out as it is very essential that it should be as nearly perfect as the state of the art will admit=

In haste Yours

T A Edison

ALS, HuBPo, TP. [a]Obscured overwritten letters.

[1] Joshua Bailey. A typed transcript of the letter to Puskas is in TP (a photocopy of the original, which may also be in TP, is at NjWOE). Dated 21 March, it states: "This will be handed to you by Mr Bailey who goes to Europe to represent the Gray interest. He desires to effect a consolidation of certain Telephone interests. I leave this matter wholly to your descretion."

-1272-

To Theodore Puskas

[Menlo Park,] Mch 29=78

Friend Puskas:

V and[a] V Letter recd[1] I will see Serrell at once he is now preparing the second English patent=[2] If your lawyer will carefully examine that patent[3] he will find that the phono & Telephone are knit together that there is not two distinct inventions because I have combined with the Telephone a machine to record making it a Recording Telephone= How ever I am in the dark here about their laws I wish you would have them write out and send this

What paragraphs claims etc do they suggest shall be disclaimed=[4]

In Haste Yours

T A Edison

P.S. 60[b] people just left for NY came down in a special car—all big bugs=[5]

ALS, HuBPo, TP. [a]Circled. [b]Obscured overwritten letter.

1. This is a response to Puskas's 18 March letter (Doc. 1259) enclosing letters from Vallance & Vallance; these letters have not been found.

2. The provisional specification of British Patent 1,644 (1878) was filed on 24 April.

3. That is, Edison's first British patent covering the phonograph, No. 2,909 (1877).

4. The same day, Edison wrote another letter to Puskas about this issue:

> As far as I can learn I think I am entitled to every claim I have made in my patent and possibly I could prove priority of invention on every one. What I want to know is this
>
> If a person patents an article and makes a great number of claims all of which he is entitled to by reason of being the first can he not hold them or is the number of claims limited I want some light. Let them specify. [TP]

5. Nothing is known of this visit. However, an illustration of Edison demonstrating the phonograph to visitors at his laboratory, published in the 30 March issue of *Frank Leslie's Illustrated Newspaper,* represents a visit from around this time. "The Latest Scientific Wonder," Cat. 1240, item 428, Batchelor (*TAEM* 94:129).

-1273-

From Vesey Butler

New York— March 31st [1878][1]

Important immediate

My dear Sir—

I have the great pleasure to inform you that my wife & ten children have just arrived from Havana (also our four nigro servants) as we propose to spend some three or four weeks at your hospitable mansion. I thought it would be well to let you know beforehand so as to get things ready— Tell your amiable lady that she need not make any special arrangements for us as my wife is very easily pleased & is a charming companion— the darling children are very good— My poor servants are very helpless & may require a good Irish servant to attend to them— have the beds well aired and extra blankets as we are rather[a] chilly from long residence in Habana—

My wife is deeply interested in Science in fact a blue-stocking— Mrs Edison might give her an idea of the working of that useful invention the Sewing Machine—

Please have some Rye whiskey & Bass ale in stock. My presence no doubt will assist you greatly in the development of your ideas I hope to make a great man of you yet

God bless you my noble friend   Your sincere friend & Colleague[a]

V F Butler[2]

My friend Mr James[3] will accompany us & will require a room or two with Bath (hot & cold water) & all modern[a] improvements. VFB

ALS, NjWOE, DF (*TAEM* 15:306). [a]Obscured overwritten letters.

1. Butler wrote from New York on 5 March, from Ansonia, Conn., on 21 March, and from Havana on 17 May, when he told Edison, "I write to you in order that it may not be a case of 'out of sight out of mind.'" DF (*TAEM* 19:840; 15:377, 676).

2. Nothing is known of Vesey Butler beyond his association with Edison. The jocular familiarity shown in correspondence such as this indicates that he knew Edison rather well, perhaps as a telegraph operator. In 1876 he was selling Edison's electric-pen copying system. He continued his association with Edison through 1880, promoting the inventor's electrical inventions in Cuba. See *TAEM-G1,* s.v. "Butler, Vesey F."

3. On 5 March, Butler wrote from New York,

> I was very much surprised at meeting a man today who told me he was Profr Edisons agent for the "Telefone" in the Island of Cuba—the individuals name is "James"—and I told him that I had an idea that he was mistaken that I was Butler of Havana & I considered myself one of Professor Edisons special staff & his head cook & bottle washer in Cuba—& nearly two years in his respectable service—& that if there was any Telephoning to be done that I was the boy who was going to do it— [DF (*TAEM* 19:840)]

-1274-

From George Bliss

Chicago April 1 1878[a]

Dear Sir:

Dont forget that only 30 days remain to get your exhibet to Paris. Nothing will be received after May 1st.[1] Gray's goods have already gone forward.[2] Gray thinks when his case goes into the patent office that he shall make a scoop on the Telephone.[3] He has a bell shaped ring with diapham & on the inside a common electromagnet[b] attracting diaphram   Also a bottle shaped arrangement with diaphram in place of bottom and electromagnet[b] outside attracting diaphram both made in 1874 also model of water telephone described in caveat and these with other claims, & descriptions, patents &c pertaining to the harmonic system he expects will take him through with flying colors. He even claims induction coil arrangements in some of his patents. He wants to know why the Bell people dont hurry up and commence suit and says they will be sued unless the fight is begun by them. I see nothing to change my opinion that you have the telephone and the party who gets it will have a great advantage. I hope you will get a good contract and be able to look on a disinterested spectator. V. Prest Walker of the Gold & Stock has been here. I think Gray has realized on enough of his interest so that he feels independent. He is disposed to congratulate you on your good telephone luck and thinks this is a case where the inventors win![4] Respectfully

Geo. H. Bliss G.M.[5]

Is there such a thing as an Automatic Press?[6]

ALS, NjWOE, DF (*TAEM* 19:677). Letterhead of the Electric Pen and Duplicating Press, George Bliss, General Manager; letterhead and dateline are electric pen copy. [a]"Chicago" and "1878" preprinted. [b]"electro" written under date, marked for insertion in text.

1. 1 May was the scheduled opening day of the 1878 Universal Exposition in Paris.

2. Elisha Gray exhibited several "Apparatus for Transmitting Musical and Other Sound by Telegraph," including telephones and devices for acoustic telegraphy. Pickering 1878, s.v. "Gray, Elisha."

3. Bliss is referring to the pending Patent Office interference proceedings and Gray's claims of priority to the invention of the telephone. See Doc. 1270 n. 9.

4. On 19 April, Bliss wrote Edison, "Gray now draws compensation from the Telephone Co. He spends most of his time in the country ala Edison! He came in a day or two ago and remarked that 'I did not need to go down to Menlo Park to find material for a newspaper article.' It makes all the difference in the world how a fellow feels about that." DF (*TAEM* 18: 288).

5. Edison drafted a note to Zenas Wilbur in the margins of the first page of this letter and then heavily canceled much of it. The legible remnant is: ". . . ~~made at the time mentioned— The whole thing I believe~~ to be a damned Swindle GBP is to get 3/10 of Grays Interest & Pope 1/10 for doing the business Edison."

6. That is, the rotary press for use with the electric pen.

-1275-

From Josiah Reiff

New York, Apl 2nd 1878[a]

T.A.E.

Col Gouraud arrived from Europe today to remain one week. He is fresh from Sir Wm Thomson, Preece, Fleming[1] & others & can give Expression to their views of Edison— The Telephone, Phonograph etc. Preece says the time has now come to utilize automatic & other improvements with P.O. Dept. Many prejudices have been broken down & the fever of improvement seems to be on— Sir Wm Thomson said the other day that Edison is undoubtedly one of the leading Electrical genius's of the day— It is therefore the opportunity to utilize the reputation your own work has given you stimulated by our friends— You will notice that all my friends recognize your merit & laud it & dont call you "thief"—"fraud," "Prof of duplicity"—"void of moral sense" etc etc, as the friends of some other people do.[2]

I wrote you several times lately about Washington matters etc, but you did not answer.[3]

If in town tomorrow let me know & also call on Gouraud at Mercantile Trust Co. Equitable building, 120 Bway.

Dont settle with A&P for salary for less than $5,000 & the other Bill for its face with their note say at 4 mos.[4]

Otherwise you better take nothing.

I submitted the paper I showed you & Wm[5] told me yesterday he would have reply for me[b] within day or two.

How about the Graphic yesterday & the "Food for the world"[6] Yrs

JCR

PS Have you made definite disposition of Telephone abroad. Gouraud wants to know.

ALS, NjWOE, DF (*TAEM* 15:448). Letterhead of J. C. Reiff. [a]"New York," and "187" preprinted. [b]"for me" interlined above.

1. Probably John Fleming of Smith, Fleming and Co.
2. See *TAEB* 2:305–9.
3. Reiff to TAE, 19 and 22 Mar. 1878, DF (*TAEM* 19:448, 663).
4. Edison was suing Atlantic and Pacific Telegraph Co. for his salary as company electrician. He settled this suit and the Domestic Telegraph Co. suit (see Doc. 1170 n. 1) about ten days later when he accepted a payment of $1,500. A&P Executive (1878–79): 7–8; see also TAE to George Norris, 23 Mar. 1878, Lbk. 3:461 (*TAEM* 28:311).
5. Neither the paper nor "Wm" have been identified.
6. See Doc. 1282 n. 1.

-1276-

Gardiner Hubbard to Uriah Painter

New York April 2d 1878[a]

Dear Sir

I have had a long conference with Mr Johnson this morning in regard to the Phonograph. I find from him that almost all the letters of inquiry for purchasers of Phonographs have been from parties who desire to use them for exhibition purposes.

There are from 10 to 12 letters a day of this kind received by Mr Johnson and as many more by Mr Edison. I have therefore concluded, provided it meets your approval to have a large Phonograph prepared which can be used for lecture, musical and other public entertainments and also for private use to be sold for $100 each. These will be sent out in advance of the Standard machine which will not be ready for several months.[1]

I propose to send out circulars to the various agents of the Bell Telephone Co asking them to notify us by the 10th of April how many of these instruments they desire, that they will be ready for delivery by the 1st of May, that they must pay an advance on each machine and the price of packing and Freight, that they will be allowed a commission of 15% on the cost price[2]

The cost of these instruments will be about $15, the outfit say $5 more making $20.—

Royalty to Mr Edison 20% or	20.—
Commission to Agents	15.—
Making Total Expense	$55.—
Net profit to us $45.—	

We incur no risk as we shall not deliver any until payment of the advance which is sufficient to cover the cost and disbursements

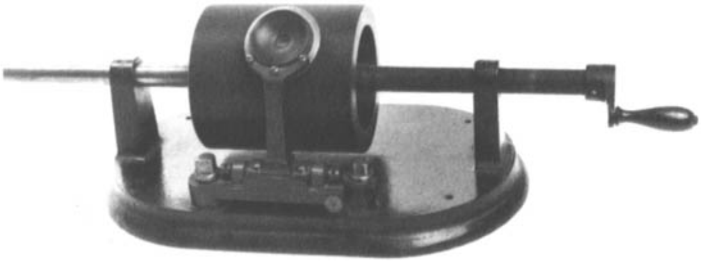
Please inform me by return mail if this arrangement is satisfactory. I have given up the design of public exhibition as it was complicated and would render it almost impossible to sell any Phonographs[3]

The small instruments are not yet ready but will be today or tomorrow[4] I am Yours Truly

Gardiner G. Hubbard per Gref [Steno.?][5]

L, NjWAT, Box 1205. Letterhead of Charles Cheever, Treasurer. [a]"New York" and "187" preprinted.

[1] Edward Johnson had begun to receive manufacturing bids for twenty-five large phonographs at the end of March. The instruments, made by Wm. G. & G. Greenfield (also known as the Hope Machine Works) of East Newark, were to be capable of recording six times more than the small demonstration phonographs (Doc. 1195). The completed instruments actually recorded five times as much. The Greenfield shop produced twenty-six machines, one of which is in the private collection of Charles Hummel. Although Johnson initially hoped to provide clockwork drives for the large cylinder phonographs, none were ever supplied. Johnson to Painter, 28 Mar. 1878, and Cheever to



One of the phonographs manufactured by Wm. G. & G. Greenfield for the Edison Speaking Phonograph Co.

Hubbard, 30 Mar. 1878, both Box 1205, NjWAT; Wm. G. & G. Greenfield bill to Edison Speaking Phonograph Co., 1 July 1878, and Edison Speaking Phonograph Co. circular, Form 502, n.d., both UHP; Wm. G. & G. Greenfield to TAE, 27 June and 5 July 1878, both DF (*TAEM* 19:90, 94). Regarding the letters of inquiry see 78-018 (DF [*TAEM* 17:877]) and scrapbooks of "Applications for Phonographs" (UHP).

The Edison Speaking Phonograph Co. advertised the small phonograph as suitable for "private use and instruction, being very portable." Johnson believed that the large phonograph would be more suitable for public entertainments such as lectures and musical performances. Like the small ones, they were offered only for "experimental demonstration, in advance of the Standard Instrument which Mr. Edison is now at work upon, and which, when completed, will be practically applied to numerous branches of commercial and scientific industry." The standard, which was not expected to be ready for three to six months, was to be a disk phonograph. Edison Speaking Phonograph Co. circular, Form 502, n.d., UHP; Johnson to Painter, 28 Mar. 1878, Box 1205, NjWAT.

2. It is unknown if a special circular was printed for Bell Telephone agents. Johnson printed a circular for the Edison Speaking Phonograph Co. (which may not have been distributed) offering for sale small $30 and large $60 phonographs and the outfits for them. The outfit comprised five pounds of tinfoil, a gum pot and brush, an extra embossing point, a piece of rubber for damping, a centering pin, and a small screwdriver, all in a "Neat Box." Edison Speaking Phonograph Co. circular, Form 502, n.d., UHP; Hilborne Roosevelt to Gardiner Hubbard, 12 Apr. 1878, Box 1205, NjWAT.

3. In a 20 March letter to Hubbard, Charles Cheever had proposed leasing small phonographs to lecturers who would have exclusive rights to exhibit within assigned territories. Cheever believed "the interest in the thing as a lecture will only last while it is a novelty and for that reason it seems best to start the thing at one and the same time in all parts of the country" through such leasing plans. Cheever expected that purchasers of the small phonograph would either lose interest in its novelty or become dissatisfied as improved models were made available. He thought the main advantage of

> leasing the small machines for a year instead of selling them is that by the end of the year we suppose our apparatus will be so much more perfect in every way, that the apparatus now made will be a detriment to us rather than a benefit if in the hands of the public and we therefor prefer to call them in and smash them up. [Box 1205, NjWAT]

Johnson's circular (see note 2) indicated that the phonograph company was planning to sell these instruments and was "not at present prepared to appoint exclusive agents."

4. Although Johnson ordered twenty-five small ($30) phonographs, the company only sold five in April. Edison received a 20% royalty on each machine. One small phonograph was sent that month to Thomas Watson, superintendent of the Bell Telephone Co. The company failed to sell any others until the following January. See Doc. 1302; Edison Speaking Phonograph Co. to Watson, 15 Apr. 1878, Box 1205, NjWAT; Edison Speaking Phonograph Co. royalty statement for April 1878, DF (*TAEM* 19:175); Doc. 1397 n. 3.

5. Anthony Gref, Jr., was a clerk or secretary to Charles Cheever.

-1277-

William Croffut Article in the New York Daily Graphic

New York, April 2, 1878.

THE PAPA OF THE PHONOGRAPH.[a]

AN AFTERNOON WITH EDISON, THE INVENTOR OF THE TALKING MACHINES.[a]

HIS HOME AND WORKSHOP IN MENLO PARK—

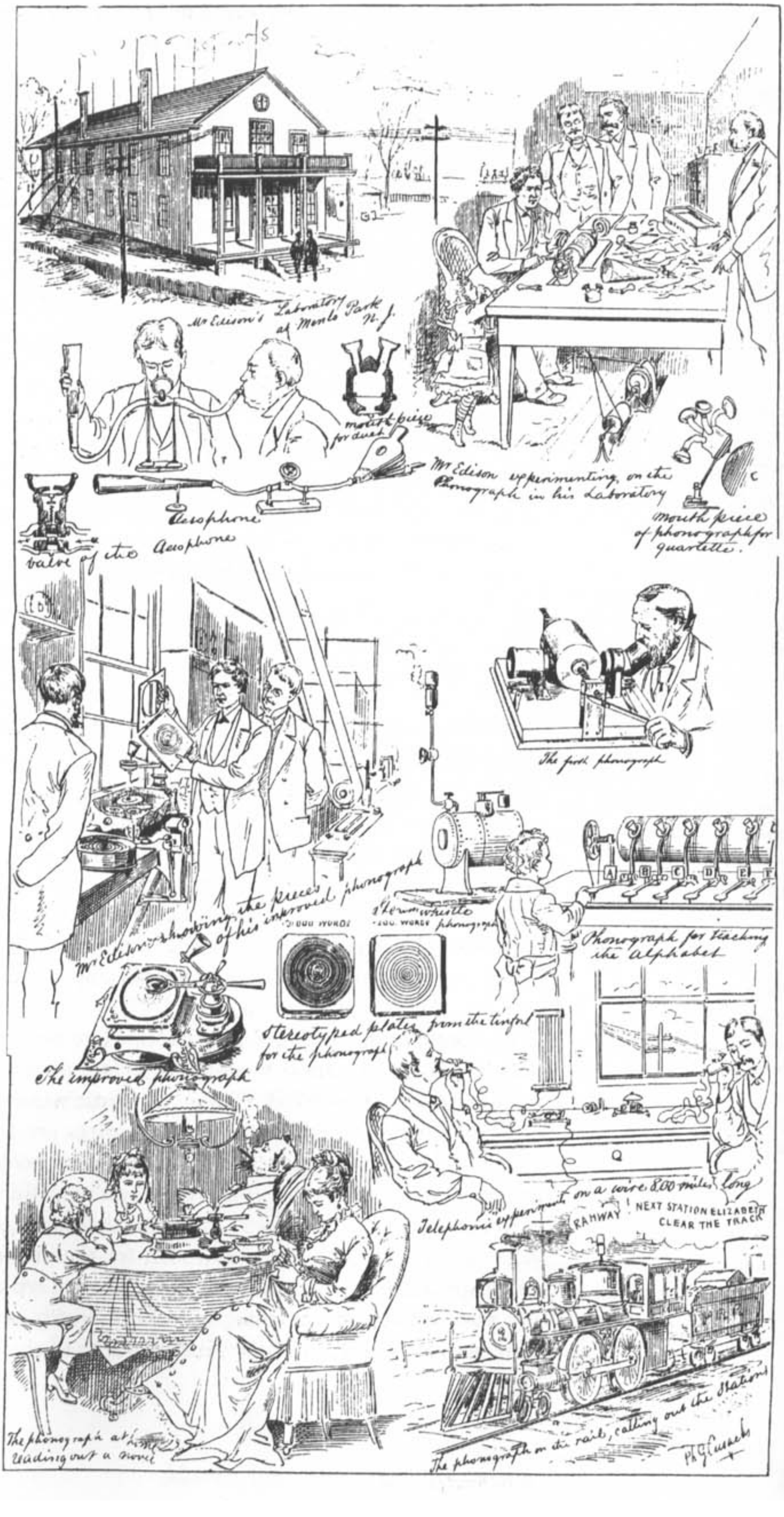
A FOUR-MILE SPEECH BY STEAM.

SKETCHES AT THOMAS A. EDISON'S LABORATORY AT MENLO PARK, N.J.

A VISIT TO THE INVENTOR OF THE PHONOGRAPH.

We went over to Menlo Park, N.J., two of us,[1] to see Edison and his wonderful inventions and make some discoveries and sketches for THE GRAPHIC. Menlo Park is not a park. It is not a city. It is not a town. It is not in any way related to Mungo Park,[2] the great Scotch-African. Although it is on the Pennsylvania Railroad (just beyond Rahway), it is not even a stopping place, except when the station agent flags the train to take on waiting passengers. It is composed wholly of Edison's laboratory and half a dozen houses where his employes live. It is, in short, Edisonia, and nothing else.[3]

Just north of the track is a long, plain, white wooden building, full of windows and two stories high (see picture); this is the laboratory of the Jersey Columbus whose name has suddenly become famous. Many telegraph wires are festooned from it. The first floor is occupied by scribes and bookkeepers in one end, and at the other some ten or twelve skilful workers in iron, who, at anvil and forge, lathe and drill, are noisily engaged in making patterns and models for the genius of the establishment. His iron ideas, in tangled shapes, are scattered and piled everywhere; turning lathes are thickly set on the floor, and the room is filled with the screech of the tortured metal.


Mr Edison's Laboratory at Menlo Park N. J.
Mr Edison experimenting on the Phonograph in his Laboratory
mouth piece for duet
Aerophone
valve of the Aerophone
mouth piece of phonograph for quartette.
The first phonograph
Mr Edison showing the pieces of his improved phonograph
Steam whistle
2000 WORDS
200 WORDS phonograph
Phonograph for teaching the Alphabet
A
B
C
D
E
F
Stereotyped plates from the tinfoil for the phonograph
The improved phonograph
Telephonic experiments on a wire 800 miles long
RAHWAY! NEXT STATION ELIZABETH CLEAR THE TRACK
The phonograph at home reading out a novel
The phonograph on the rail, calling out the Stations
Ph G Cusachs

Up stairs we climb—to a room the size of the building, with twenty windows on sides and ends. It is walled with shelves of bottles, like an apothecary shop—thousands of bottles of all sizes and colors. In the corner is a cabinet organ. On benches and tables are batteries of all descriptions, microscopes, magnifying glasses, crucibles, retorts, an ash-covered forge, and all the apparatus of a chemist. At a table sit two earnest men (see picture) each holding alternately to mouth and ear the mouthpiece of a telephone.

"Well, what are you up to to-day?" asks an acquaintance who has sauntered in.

"We have got the Chicago telephone repeater[4] in the circuit at last, and we are now talking through 800 miles of wire, via St. Louis, Cincinnati, Louisville, Washington and Philadelphia—the parabola of the West. It doesn't work well yet. This is the largest circuit ever attempted and it would not be possible without Edison's repeating machine. What's that? Can't hear all the words!"

This last he shouted into the mouthpiece and the words flew to the Mississippi and back in a second, and the man across the table shouted back, "Do you hear me now?"

Two other men are standing near together in the middle of the room.

"Why, you be! You certainly be!" exclaimed the elder with much earnestness. "You air the greatist man in the world today!"

"Oh, nonsense! Don't talk that way!" said the younger, laughing and waving him off deprecatingly as he turned quickly and greeted us with a shy welcome.

That the man who first spoke was altogether in earnest his face and voice were a sufficient assurance. He was apparently a farmer who had put on his Sunday apparel and driven down to Menlo Park to see the marvels of which he had incredulously heard. And now, though the miracle-worker turned away from him, he added, in a strident tone, "You air the most popler man in Ameriky! There ain't any man the people air so anxious to see!"

The younger man was now busy with a sheet of tinfoil, which he had laid on a piece of cardboard and was trying to rub the wrinkles out of. He is a man about five feet ten inches high with a thin face, high cheek bones and lean, long neck. He would not be picked out in a crowd as a man of more than ordinary intelligence, and he is the person whom a banco steerer[5] would be likely to take into his confidence. Time he evidently considers too valuable to waste on personal decoration, for his boots have not been blackened this week, and, although he is ostensibly whiskerless, his beard has had about a five days' growth. His hair is of a chestnut brown, and I judge he cuts it himself, for it stands up in an anxious way all over his head, with a striking tendency forward, and at the crown it stiffly radiates like the thorny top of a pineapple. There is a quid of tobacco in his cheek. His mouth is sensitive, the blue veins show on his hands and the fingers flutter as if each had an intelligent purpose; but the only feature that would immediately attract the attention of a stranger as worth a second look is his keen, deep, eager gray eye which reveals the intensity of the man. This is Thomas Alva Edison.

"You have turned out a good many inventions, Mr. Edison."

"Yes;" he answers, with a perceptible Western twang in his speech, "I've made some machines; but this is my baby," patting the speaking phonograph and taking a chair before it, "and I expect it to grow up to be a big feller and support me in my old age."

He touches a lever with his foot, and shifts a narrow belt upon the phonograph cylinder, which is thus operated through the floor by the large steam-engine below (see picture). The cylinder is three inches in diameter, and makes some forty or fifty revolutions a minute. It is covered with a fresh and perfectly smooth sheet of tinfoil.

Into a simple mouthpiece at the side Mr. Edison speaks, in a loud tone of voice, addressing a Spanish gentleman who has just been presented, "*Buenos dias Senor, como esta usted?*" To which the gentleman, taking his place at the phonograph, immediately replies, "*Setze judges mentjan fetxa d'un penjat.*" This exchange of compliments has occupied, perhaps, a minute of time.

Edison touches his foot to the lever and stops the cylinder and turns back the mouthpiece from contact with it. We examine the tinfoil. At least half of that which was smooth before is now corrugated, creased in lines running close together, fifteen to the inch, most of the creases being marked with small and scarcely perceptible indentations. (THE GRAPHIC has already given a picture of these marks, and of the sharp stylus with which they are made.) Meantime the cylinder has been moved a couple of inches towards the right by means of a thread in the bearings.

Edison touches the lever again and reverses the movement, until the cylinder, following the screw thread, has returned to the point of starting. Then he replaces the mouthpiece; starts the cylinder; the little stylus, pressed down, again traverses the spiral line of indentations, and, lo! the machine talks! From the mouthpiece comes the Spanish salutation, *"Buenos dias, Senor,"* &c.—not more than a quarter as loud as when first spoken, but perfect in articulation and inflection, even the timbre of the two voices being plainly distinguishable.

Edison then speaks into the mouthpiece: "Mary had a little lamb its fleece was white as Jack and Jill went oh stop that! shut up!"—the last rebukes being sharply spoken. It is presently repeated by the machine with startling effect—but as the cylinder is set back a little too far it laps over upon the former speech and comes out, "Fetxa d'un penjat Mary had a little lamb," &c.

The sheet is not at all injured by the service, and can be preserved forever or sent anywhere, and whenever laid on a phonograph cylinder will exactly repeat the voice that has been impressed on it.

The machine can whistle as well as talk. Edison whistles into the mouthpiece a bit of an opera, and it is returned as clear as a bell and apparently without much diminution.

To show its precocity in dialect, he shouts in a strident tone: "Ah-a-a-I say-stranger-ah-ah-would you-ah-would you-ah-ah-how far is it-ah-ah-what time is it?" The machine repeats the absurd speech precisely, and its stammers are very amusing indeed.

The sheet is now full to the edge, wrinkled and speckled, and Edison tears it off, throws it away and substitutes a fresh one. "Shall we give you a song?" he asks, and, as the suggestion is received with applause by the ten or a dozen visitors, he calls an assistant, adjusts a queer-looking double mouthpiece with two tubes meeting in one (see picture), and they sing, "Tramp, tramp, tramp, the boys are marching"—[6] the assistant singing bass and Edison singing the air in a bass voice.

He turns back the cylinder, puts on steam, and presently the machine begins to sing that famous war-song—all the words being clearly articulated, and the two parts being perfectly distinct.

"What'll you have next?" asks Edison. "Shakespeare," replies THE GRAPHIC. And the inventor gives this to the machine in a solemn tone:

"Now is the winter of our discontent
Made glorious summer by this son of York;

And all the clouds that lower'd upon our house
In the deep bosom of the ocean buried!"[7]

It was returned in a tone of voice and accentuation almost melancholy, the declamation being quite tragic. The word "lowered" was mispronounced as it had been at first, to rhyme with "board" instead of "showered," and many characteristics of the voice were preserved.

"A dog came along here the other day and barked in the mouthpiece," said Edison, "and the voice was admirably reproduced. We have hung up that sheet yonder, and now we can make him bark any time. That dog, perchance, may die and pass away to dog-heaven," added he in a blood-curdling voice and an impressive wave of the hand, "but we've got them—all that is vocal survives."

"Now you try it," he said to a gentleman present, offering the chair, and while a laugh went up at the expense of that gentleman, he took the mouthpiece and delivered the following in a deep bass:

"The boast of heraldry, the pomp of power,
And all that beauty, all that wealth e'er gave,
Alike await the inevitable hour—
The path of glory leads but to the grave."[8]

"If a friend of yours were to speak in here in your absence, would you recognize it when repeated from the tinfoil?" I asked him.

"We have tried it and sometimes can tell easily, but the phonograph is a young thing yet and must be greatly improved before it will do just what it should. Tinfoil is not exactly the thing; it wrinkles so easily; and this needle is too 'scratchy.' Johnson is getting me a sapphire point[9] to take its place. I tried a sapphire, and the softest whisper was reproduced accurately and the vocal timbre was exactly retained. You could tell the voice in a minute."

"Two other things I am going to do—substitute some sort of membrane for this ferrotype-tympanum,[10] and put some sort of a voice-chamber over the mouthpiece about the size of the human mouth with teeth and perhaps tongue. This will give the resonance that is lacking in this machine.

"Another thing I am going to do right away—abolish this whole cylinder and supersede it with a flat circular steel plate about as big as a dinner-plate. This plate will be reamed with a fine groove running around itself, beginning in the centre and ending in the circumference. I can make that groove so fine that the plate will hold 50,000 words—(see picture)—

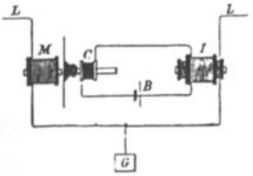
that is, it will hold the whole of one of Dickens's novels.[11] My puzzle now is to decide whether to make it fine enough to hold 50,000 words or coarse enough to hold only 200. A merchant may not want all his business mixed up on his phonograph. He may prefer to shift the tinfoil."

PD, *New York Daily Graphic*, 2 Apr. 1878, 221. In Cat. 1031:75, Scraps. (*TAEM* 27:776) and Cat. 1240:472, Batchelor (*TAEM* 94:151). [a]Followed by centered horizontal line.

1. For Croffut's authorship see Doc. 1266. He was evidently accompanied by Peter Cusacks, an artist, whose signature is in the lower right corner of the illustration. Wilson 1878, 307.

2. Mungo Park was a Scottish surgeon and explorer who made several expeditions to Africa. He died leading a British party down the Niger River in 1806. *DNB*, s.v. "Park, Mungo."

3. See *TAEB* 3:3–4.



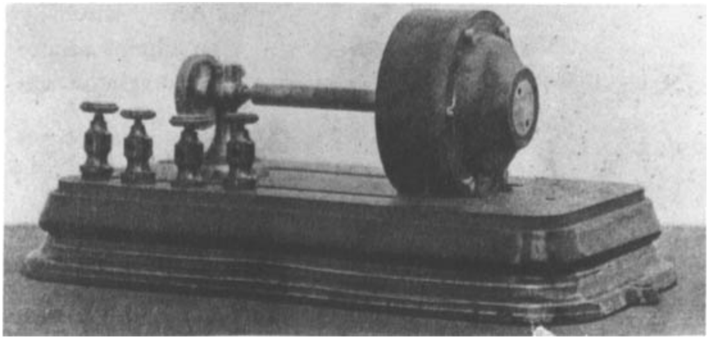
Circuit diagram of Edison's telephonic repeater.

4. Repeaters were used to overcome the attenuation of electrical signals over long distances. They were used routinely in long-distance telegraphy, although Edison had been unable to develop a repeater well-adapted to the rapid transmission of signals by automatic telegraphy (*TAEB* 1:30–31; 2:661). The even higher frequency of telephone signals posed still greater difficulties, which were not overcome until the early twentieth century (Wasserman 1985; Fagen 1975). In April 1877, Edison had developed his first telephone repeater—the pressure relay (see Docs. 885, 887, 926).

The repeater discussed by the *Graphic* consisted of a magnet (M), a carbon-telephone transmitter (C), and an induction coil (I). As the magnet responded to fluctuations in the main line current, it activated the transmitter by vibrating its diaphragm which in turn pressed on the carbon button and altered the resistance of the repeater circuit. This varied the resistance of the primary winding of the induction coil and induced a current in the secondary winding, which was passed to the main line. This device is illustrated and described in Prescott 1878c, 39–40.

5. Slang term for a swindler or confidence man. Farmer and Henley 1970, s.v. "banco-steerer."

6. "Tramp, Tramp, Tramp, the Boys are Marching," by George Root,



An 1878 photograph of the telephonic repeater.

was a popular Union song during the Civil War. *DAB,* s.v. “Root, George Frederick.”

7. The opening lines from Shakespeare’s *Richard III* occasionally appeared in Edison’s notebooks; he and Batchelor also used them for the text of electric pen tests. See, for example, Cat. 298:133(2); NS-77-004; all Lab. (*TAEM* 5:259; 7:539); DF (*TAEM* 13:290, 293, 295).

8. This quotation is from Thomas Gray’s “Elegy Written in a Country Church-Yard.” Edison had inscribed this stanza in laboratory notebooks on at least two previous occasions. Cat. 297:88, NS-77-004, both Lab. (*TAEM* 5:798, 7:619).

9. Edison experimented with different substances, including sapphire, as recording points for his phonograph. See Doc. 1242 n. 7 and Johnson to TAE, 28 Mar. 1878, DF (*TAEM* 19:53).

10. Alfred Mayer had suggested this to Edison in early March (see Doc. 1242 n. 2).

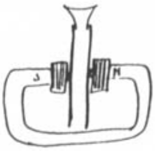
11. Charles Dickens’s novels are actually considerably longer. Edison repeated this claim in the *North American Review..* Edison and Johnson 1878, 531, 534.

-1278-

Notebook Entry: Telephony

[Menlo Park,] Apl 2nd 1878

We had a test today with Edison in New York and Batchelor in Philadelphia of the Edison Carbon telephone and the Phelps Magneto telephone. The wire used was a no 6 wire and runs right along the railroad amongst 22 or 23 other wires some of which were working the Washington ‘Quad’. The induction was very heavy notwithstanding this Orton and Bentley conversed with perfect ease on the Edison instrument whereas with the Phelps not a single distinguishable word could be got.[1] The Edison was the most improved pattern transmitter with thick plate and solid connection between the plate and the aluminium so that it works more by pressure than by vibration[2] The Phelps was a new large magnet and double diaphragm placed as in sketch and when put on the line the usual ‘frying pan’ is turned into a complete roar.[3]



Nothing could be got over the wire and in a conversation over the Edison instrument Mr Phelps acknowledged to Mr Orton that the magneto was not capable of working such wires

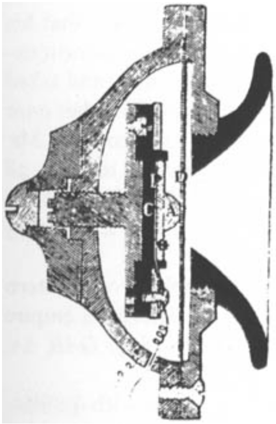
CB

X, NjWOE, Batchelor, Cat. 1317:56 (*TAEM* 90:685). Written by Charles Batchelor.

1. Batchelor entered in his diary that day: “Orton Bentley & many others conversed over the wire but could not get a single word over Phelps.” According to press accounts, several dozen witnesses shared nine receivers in Bentley’s office to listen to the conversations. Present

were George Phelps and James Merrihew, Western Union superintendent for Philadelphia. Among those with Edison and Orton at the Western Union building in New York was George Phelps, Jr. Philadelphia newspapers reported enthusiastically on the carbon telephone's "highly successful" hour-long test over the difficult route to New York. They also gave more charitable reviews of the magneto's performance than Batchelor did; one noted that it transmitted "words and occasional sentences." Cat. 1233:92; "Experiments with Telephones," *Philadelphia Record* and "Long-Range Chatting," *Philadelphia Times,* both 3 Apr. 1878, Cat. 1240, items 493, 496; all Batchelor (*TAEM* 90:99, 94:156).

2. The telephone in question is probably the design shown in George Prescott's article from the August 1878 issue of *Scribner's Monthly* (Prescott 1878d, 601–2). In this article and in the revised edition of his book on telephony (Prescott 1879, 565–67), Prescott presented this design as the new form of transmitter that followed Edison's decision to remove the rubber tube in mid-March (see Doc. 1252). In the first edition of his book, which appeared in June, Prescott added a paragraph at the last moment (probably in late March or early April) which discussed but did not illustrate "the latest form of transmitter which Mr. Edison has introduced" (Prescott 1878c, 36–37). In the *Scribner's* article, this paragraph introduces the drawing and description of this transmitter:



Edison's carbon-telephone transmitter design of early April.

> The prepared carbon, represented at C, is contained in a hard-rubber block open clear through so that one side of the former is made to rest upon the metallic part of the frame which forms one side of the connections of the circuit. The opposite side of the carbon is covered with a circular piece of platinum foil, P, with leads to a binding post insulated from the frame and forming the other connection for placing the instrument in circuit. A glass disk, G, upon which is placed a projecting knob, A, of aluminum, is glued to the foil; and the diaphragm, D, connecting with the knob serves when spoken against, to communicate the resulting pressure to the carbon. A substantial metallic frame surrounds the carbon and its connections, and their complete protection against injury, to which they are liable from careless handling, is thereby secured.

Prescott also indicated in the article that the function of the design was "to concentrate a greater pressure upon the small surface of the carbon."

3. See Doc. 1173 n. 3.

-1279-

From Edward Johnson

[New York,] Apl 3/78

Edison

If you are in town today come direct here before going to W.U. Mr H[ubbard]. wants to see you was sorry he missed you yesterday He leaves this P.M.

Johnson

ALS, NjWOE, DF (*TAEM* 15:455).

-1280-

From Edward Johnson

NY 4/3/78

E

Ans me about Barker[1] am waiting on you B4 answering him

"Jo"

O[rton]. called in Vanderbilt[2] to help him decide on your terms[3] Don't Budge an inch "Jo"

ALS, NjWOE, DF (*TAEM* 15:454).

1. This letter was prompted by George Barker's letter of 31 March in which he asked for Johnson's help in exhibiting Edison's phonograph and musical telephone during his 15 April lecture at the Philadelphia Academy of Music. At Edison's request, Johnson had offered his phonograph to Barker, but there had been some confusion on Barker's part as to whether he would have to pay Johnson the $100 fee he charged for phonograph exhibitions (see Doc. 1211). On 26 March, Edison wrote Johnson and asked if he would be willing to waive the fee if Barker paid his expenses and in his 31 March letter Barker himself stated that he could not pay the fee. On 4 April, Johnson replied to Barker that his promised phonograph was unavailable because it was on permanent exhibition in New York. On 6 April, Barker expressed dismay and asked if Johnson could "get Edison's for that evening, for I would rather omit the phonograph altogether, than attempt to use the little concern Mr. Bentley had here." Barker to TAE, 25 Mar. 1878; Johnson to TAE, 28 Mar. 1878; Barker to Johnson, 31 Mar. and 6 Apr. 1878; all DF (*TAEM* 15:395, 414, 434, 472); TAE to Johnson, 26 Mar. 1878, Lbk. 1:473 (*TAEM* 28:319); see also Doc. 1286.
2. William Vanderbilt was the majority stockholder of Western Union. He had taken over the family's railroad and telegraph empire after the death of his father, Cornelius, in January 1877. *DAB*, s.v. "Vanderbilt, William Henry"; Klein 1986, 202.
3. Although there is no record of Orton's discussions with Vanderbilt, on 6 April Orton and other directors of the American Speaking Telephone Co. met informally to discuss the proposed agreement with Edison regarding his carbon telephone. (A majority of the board was affiliated with Western Union.) On 16 April the full board of the company approved a resolution agreeing that Western Union should guarantee Edison a payment of up to $6,000 per year for the life of the patents with American Speaking Telephone to assume the actual costs. The directors also wanted the agreement to provide for the acquisition of his future telephone patents to "be bought, and paid for, year by year, as patents are secured at a price, not to exceed a moderate fixed sum in any one year, rather than by adding to the contemplated annuity." American Speaking Telephone Minutes, 25.

-1281-

To Henry Olcott

Menlo Park. N.J. 4th April ~~1889~~. 1878.[1]

Dear Sir,

I herewith return signed, the forms of the Theosophical

Society, and thank you for the same.[2] Please say to Madame Blavatsky that I have received her very curious work and I thank her for the same. I SHALL READ BETWEEN THE LINES! Yours truly,

(sgd)[a] THOMAS A. EDISON.

TL (transcript), NjWOE, DF (*TAEM* 125:769). Attested "true copy" by W. R. Old, "Gen Secy. British Section T.S." [a]Written by Old.

1. On 20 December 1889, Olcott wrote Edison regarding a letter from Edison's private secretary, Alfred Tate, that had been printed in a Manchester newspaper and which claimed that Edison had never been a member of the Theosophical Society. As evidence to the contrary Olcott sent this copy of the 4 April 1878 letter in which Edison had enclosed his membership certificate. Olcott also indicated that he had a second letter from Edison "acknowledging your receipt of the Society's Diploma of Fellowship with thanks." Olcott noted that both of these letters were then at the Society's headquarters in Madras, India. DF (*TAEM* 125:767).

2. Edison's membership form is illustrated in Cranston 1993, 184. In a letter dated 30 April 1878, Helena Blavatsky told Edison that he was now "a 'Fellow' of our Society—which is more than proud of its new Son" (DF [*TAEM* 15:579]). The only role Edison played in the Theosophical Society was to waive the royalty on the exhibition phonograph purchased by the Bombay branch of the Society and to provide copies of his portrait for this and other branches of the Society (Olcott to TAE, 14 Dec. 1878; Blavatsky to TAE, 14 Dec. 1878; Edison Speaking Phonograph Co. royalty statement for December 1878; all DF [*TAEM* 16:512–14; 19:204]).

-1282-

To William Croffut

Menlo Park N.J. April 6 1878.

Friend Croffut

Your article is the most ingenious hoax that I have ever seen. Everyone, without exception was fooled by it.[1] I am receiving letters asking the lowest prices for food-machines, and asking when they will be ready for the market. I intend giving you one of the new plate machines when we get them in quantity. If I can get one of the small phono's from one of the savans to whom I have loaned them, I will let you have it[2] Perhaps one will reach here wednesday if so would it not be best for you to come down and learn how to manipulate it to the best advantage. I have a box for it and can give you a supply of foil. Yours Truly

Thomas A Edison

ALS, Hummel. This document is photographically reproduced in *Antique Phonograph Magazine,* 10 (No. 2; 1992): 9.

1. Edison was replying to Croffut's letter of 4 April in which he had asked, "Did you see my hoax? And are you in a state of fiery wrath? Or how is it?" (DF [*TAEM* 17:70]). The hoax was an article by Croffut that appeared in the 1 April *New York Daily Graphic* (p. 215), titled "A Food Creator," which described a fictitious Edison invention that could manufacture food out of air, water, and earth (Cat. 1240, item 470, Batchelor [*TAEM* 94:150]). During the 2 April telephone test (see Doc. 1278), Edison reportedly joked over the line to Batchelor in Philadelphia: "By the way, don't you want half a dozen of my latest? Invented since you left this morning. It changes fire clay into rice pudding and corn meal into gold dust. Warranted for nine hundred and ninety-nine years." ("Long-Range Chatting," *Philadelphia Times,* 3 Apr. 1878, Cat. 1240, item 496, Batchelor [*TAEM* 94:156]).

2. In his 4 April letter (see note 1), Croffut had asked to "borrow a phonograph a little while to experiment with. Have you got an old rusty one anywhere?" Edison loaned him one of the small phonographs (see Doc. 1304).

-1283-

Telegrams: From/To the North American Review

April 6, 1878[a]
New York

T. A. Edison

Mr Johnson will write article, your signature to it indispensable. please consider the character of our readers, and allow him to use it.[1] reply to

North American Review

[Menlo Park]

North American Review

All right could I see proof early monday morning.[2]

T A Edison

L and ALS (telegrams), NjWOE, DF (*TAEM* 97:649; 17:71). First message on Western Union Telegraph Co. message form. [a]Date from text, form altered.

1. The June issue of the *North American Review* carried an article with Edison's byline titled "The Phonograph and Its Future" (Edison and Johnson 1878). This article described the present capabilities of the phonograph and discussed possible uses which included "Letter-writing, and other forms of dictation books, education, reader, music, family record; and such electrotype applications as books, musical-boxes, toys, clocks, advertising and signalling apparatus, speeches, etc., etc." The article concluded by describing how the phonograph could make the telephone a valuable adjunct to long-distance telegraph service by allowing messages to be recorded. The issue carrying this article had appeared by 28 April, when several New York papers carried ex-

cerpts from it (see "The Phonograph of the Future," *New York Herald*, "Edison's Wonder," *New York Sun*, and "Practical Uses of the Phonograph," *New York Times*, Cat. 1029:24–26, Scraps. [*TAEM* 25:174–75]). The article was also reprinted in the 18 May *Scientific American Supplement* (5:1973).

2. Edison also telegraphed Johnson, "Can I see proof of Review article early monday morning." DF (*TAEM* 71:72).

-1284-

Charles Batchelor Diary Entry

[Menlo Park,] Saturday Apl 6 1878

Paid Gould Attys for suit against Edison[1] Went with Edison to A&P to fix Domestic a/c.[2]

Sent $200 to Z. F. Wilbur[3] for Edison, by Express under the name of G Wilson[4] 21 New Church St

Talked with Professor Barker at University of Pennsylvania for an hour.

D, NjWOE, Batchelor, Cat. 1233:96 (*TAEM* 90:101).

1. Ezra and Roscoe Gould, from whom Edison and George Harrington had leased space for the American Telegraph Works in October 1870, had brought suit against Edison in 1877, presumably for back rent. A final hearing before a referee had been scheduled for 6 April, but Edison finally accepted Gould's offer to settle the claim for $300. No record of the case has been found. *TAEM-G1*, s.v. "Manners, A"; receipt of 6 Apr. 1878, DF (*TAEM* 19:498).

2. See Docs. 1170 n. 1 and 1275 n. 4.

3. Zenas Wilber had written Edison on 31 March urgently requesting a confidential loan of "$200 or $250 immediately." Since Wilber was the Patent Office's chief examiner of electrical apparatus and would have reviewed many of Edison's patent applications, such a loan would likely have been considered highly inappropriate. In another letter of 31 March, James MacKenzie wrote that "our friend Wilber calls in very often and always has a talk with me about you he is evidently your staunch friend and also Prescotts (in my eye) who is going to be Prest W[estern]U[nion]T[elegraph]." DF (*TAEM* 15:432, 436); on Wilber see *TAEB* 2:87 n. 3.

4. Unidentified.

-1285-

From George Gouraud

London 9 Apl. 1878[a]

My dear Edison

I lunched yesty with Alderman Nottage who is also Sheriff of London & I think I may say that so far as he is concerned he is a very good man to have the phonograph in hand—but he is evidently not pleased at having to do with Puscus—a subject upon which he spoke with much emphasis and some feeling I thought— He expressed the hope that you had not given him Puscus a power of attorney to act for you in any commission with your interests in England— [~~and~~?] and[b] begged me to ~~put~~ persuade you not to do so. Puscus told him he had written to you to give him such a Power.[1] If not too late you may have my services in this commission upon the same terms as you had thought of giving Puscus. I am especially well situated here to cooperate with Nottage & am sure I could make your ultimate profits larger than they would be otherwise ~~be~~. It seems absolutely indespensible to your best interests that you should have some interested with you in whom you know you rely & who lives here. Preece says your ~~last~~ first telephone didnt work at all[2] He is much interested to see how the last will go. If you cable me simply Gouraud London Accepted[3]—I shall know that you accept me as yr attorney in the Phonograph and will at once advise Nottage who will I know be much pleased— I will then have proper paper drawn ready to fill in the share in the Royalty—which you shall desire to give me for my services Yours truly

Geo E Gouraud

Besides this let me know soon as you promised—what you will take for ¼ of your interest in English Royalties of Phono.

ALS, NjWOE, DF (*TAEM* 19:226). Letterhead of Mercantile Trust Co., George Gouraud, Resident Director in Europe. [a]"London" and "187" preprinted. [b]Interlined above.

1. See Doc. 1237 n. 1.
2. See Doc. 1248.
3. Edison did not cable Gouraud and did not give him power of attorney in regard to the British phonograph.

-1286-

From Edward Johnson

New York, Apl 10th 1878[a]

My Dear Edison

About Barker—

Like all other perfectly gratuitous business, this going to Philada with the Phonograph is going to give me a heap of trouble.[1] My Phonograph is under steady engagement & cannot be spared a single day or night— Applebaughs is likewise engaged in Brooklyn.[2] We shall have no others until the 23rd of this month—[3] His space is on the 15th— Now what am I to do— Can you not ship yours over on Saturday If I have it promptly returned on Tuesday.[4] Barker does not want the little unsatisfactory machines Bentley had—nor would I operate it in the presence of so large an audience as he will have at the Academy.

I am having a special Phono made for our Exhib.[5] but it will not be done in time to relieve mine—nor could I go myself if it were— Indeed I don't see how I can get away as it is I am compelled to work there now nearly all day—and to give quite an extended Lecture in the Evening—no one else can take my place— Yesterday our receipts were $84. they steadily increase day by day—by next Monday it may simply be impossible for me to go— Prof Barker seems to be filled with the Idea that I am forcing myself on him for the purpose of making[b] something— The fact is I will pay him to release me from what I volunteered to do at your suggestion before I became so involved in the meshes of this Phono. business here. It is due me, that you set me right with Barker & if possible get me released from this annoying dilema Can't you write him & explain & if possible send him your Phono instead of me.[6] He would doubtless prefer it to my personal services with a little one Truly Yours

E. H. Johnson

See what he Says in re. to E.M.G. Tel. You have it[7] EHJ

ALS, NjWOE, DF (*TAEM* 15:493). Letterhead of Edison Speaking Phonograph Co., E. H. Johnson, General Agent. [a]"New York," and "1878" preprinted. [b]Repeated at end of one page and beginning of next.

1. See Doc. 1280 n. 1.

2. According to a local paper, William Applebaugh had demonstrated an Edison phonograph at a private party in his Brooklyn home the evening of 25 February. He may have continued to exhibit his phonograph there. "Phonograph, A Machine that Talks and Sings," *Brooklyn Daily Eagle*, 26 Feb. 1878, Cat. 1240, item 385, Batchelor (*TAEM* 94:117).

3. These are probably the machines manufactured by Wm. G. & G. Greenfield. See Doc. 1276 n. 1.

4. On 9 April, Barker had asked Edison to loan Johnson a large phonograph for the Philadelphia engagement and, in return, promised to give "the Phono. Co. a big puff if they care to have it" (DF [*TAEM* 15:486]). Barker's lecture was scheduled for Monday, 15 April.

5. Nothing is known of this machine.

6. In an undated memorandum, probably written about 12 April while he was in Philadelphia helping Barker prepare for his lecture, Batchelor informed Edison that "I told him [Barker] I thought you would lend your big one [phonograph] just for that occasion." Batchelor also notified Edison that Barker "wants a rehearsal on Sunday [14 April] to the Academy and will send letter previous as to the experiments to try on that morning." DF (*TAEM* 15:517).

7. Johnson apparently enclosed Barker's 6 April letter to him in

which Barker asked Johnson to arrange with Edison to transmit music from Menlo Park over the electromotograph telephone during his lecture. DF (*TAEM* 15:472).

-1287-

From H. L. Leclare

New Orleans April 11th/78

Dear Sir:

In an account of an interview had with you—published in the "World"[1]—the Reporter states[2] that you have a preparation which will instantly stop pain.[3] He gives the ingredients but not the proportions. My wife has suffered greatly for years with pains in the back & Doctor after Doctor has failed to give her relief. Believing, with the rest of the world, that whatever you do is a success, I write this to beg of you to inform me how or where I can get a bottle of this preparation. Of course I am aware that you are not a vendor of medicine, but on the other hand, the chance of benefitting my wife makes me run the risk of being considered impertinent. If you can, without inconvenience, give me the information asked for you will greatly oblige[4] Yours most Respectfully

H. L. Leclare[5a]

⟨The reporter made a mistatement in regard to curing all pains. It relieves neurologic pains etc=[6]

1 oz[7] alcohol
2 oz Chloroform
1 oz Chloral Hydrate
1 oz Camphor Gum
1 oz Sulphuric Ether
8 grains[8] Sulphate Morphine
1 drachm[9] Oil Cassia
1 " " Cloves.

Apply externally. Do not[b] take it inwardly⟩

ALS, NjWOE, DF (*TAEM* 19:347). [a]Edison wrote "over" and then drafted his reply on the other side of the letter. [b]Underlined twice.

1. Probably "That Wonderful Edison," *New York World,* 29 Mar. 1878, Cat. 1240, item 463, Batchelor (*TAEM* 94:147).

2. The reporter was probably a Mr. Babcock, who was introduced by an 18 March letter to Edison from John Speed, editor of the *New York World.* DF (*TAEM* 17:29).

3. After briefly describing the vast range of chemicals kept in the Menlo Park laboratory, the *World* reporter asked "What is the idea of your keeping a wholesale drug-store here, Mr. Edison?" Edison replied, "I keep all these things, because I don't know how soon I may need

them. Whenever I see a new chemical or drug announced I buy it, no matter what it costs." He then described "a bottle containing a clear, straw-colored liquid" as "composed of morphine, chloral-hydrate, chloroform, nitrate of amyle, cassia and cloves. Those things have no chemical action on each other, and they'll stop any kind of pain immediately."

By the time a group of reporters visited from Boston on 22 May, Edison had labeled the preparation in the bottle "Polyform" (clipping from the *Boston Evening Transcript* of 23 May 1878 enclosed with George Chapman to TAE, 10 June 1878, DF [*TAEM* 19:365]). Edison and his assistants tried other words—polyanodyne, polypharmakon, and polymorph—as part of a general effort to find Greek-based names for several of his inventions (see Doc. 1303).

4. Edison freely provided recipes for the mixture; see other letters in 78-033, DF (*TAEM* 19:345). He did not file a patent application for it until 1879 and no U.S. patent issued (Serial No. 2,206, 8 Sept. 1879, "Medicinal Preparation" in "Abstract of Edison's Abandoned Applications," p. 12, PS [*TAEM* 8:539]). In 1880 a British patent (No. 599) was issued to William Lake, as Edison's agent. For a discussion of nineteenth-century patent medicines see Young 1961.

5. Unidentified.

6. Edison stated in his British patent that the preparation was a combination of "all of the most powerful chemical compounds which act anaesthetically," dissolved in "menstruums which are also anaesthetics" (alcohol, ether, and chloroform), all subject to the limitation that they "have no chemical action upon each other." Edison's list of ingredients and proportions here omits the amyl nitrate mentioned in the news account (see note 3) and differs from those in the British patent and elsewhere. The formulas in the U.S. and British patent applications are in agreement except for 3 pennyweights of opium included in the former, which was mentioned in the preliminary version of the latter but dropped from the final specification. The ingredients from the British patent are: "One ounce of hydrate of chloral, four ounces of alcohol, two ounces of chloroform, two ounces of camphor, two minims of oil of peppermint, two minims of oil of cloves, three pennyweights of salicylic acid, three pennyweights of nitrate amyl, two pennyweights of morphia sulphate, two ounces of ether." Brit. Pat. 599 (1880); W. H. Hayward to TAE, 9 July 1878, DF (*TAEM* 19:375); Serial No. 2,206, 8 Sept. 1879, "Medicinal Preparation" in "Abstract of Edison's Abandoned Applications," p. 12, PS (*TAEM* 8:539).

7. A fluid ounce equals 29.76 ml.

8. A grain is 1/480 troy ounce, i.e., 0.06479 g.

9. A drachm (or dram) equals 60 minims (drops) or 1/8 fluid ounce, i.e., 3.72 ml.

-1288-

From George Bliss

Chicago Apl 13th 1878[a]

Dear Sir:

I send you a dozen copies of the Tribune as requested.[1]

The Mania has broken out this way— School-girls write compositions on Edison: The funny papers publish squibs on Edison: The religious papers write editorials on Edison:[2] The daily papers write up his life: The Rev. Woodbury[b] is writing a magazine article on Edison[3] &c &c

When shall we get a visit? Respfly

Geo. H. Bliss G.M.

Why dont the Graphic fill up exclusively with Edison and done with?

ALS, NjWOE, DF (*TAEM* 17:76). Letterhead of the Electric Pen and Duplicating Press, George Bliss, General Manager; letterhead and dateline are electric pen copy. [a]"Chicago" and "1878" preprinted. [b]Obscured overwritten letter.

[1] Bliss's biographical essay on Edison had appeared in the 8 April *Chicago Tribune.* See App. 3.

[2] E.g., "Easy Enough," *Chicago Alliance,* 13 Apr. 1878, Cat. 1029:13, Scraps. (*TAEM* 25:168).

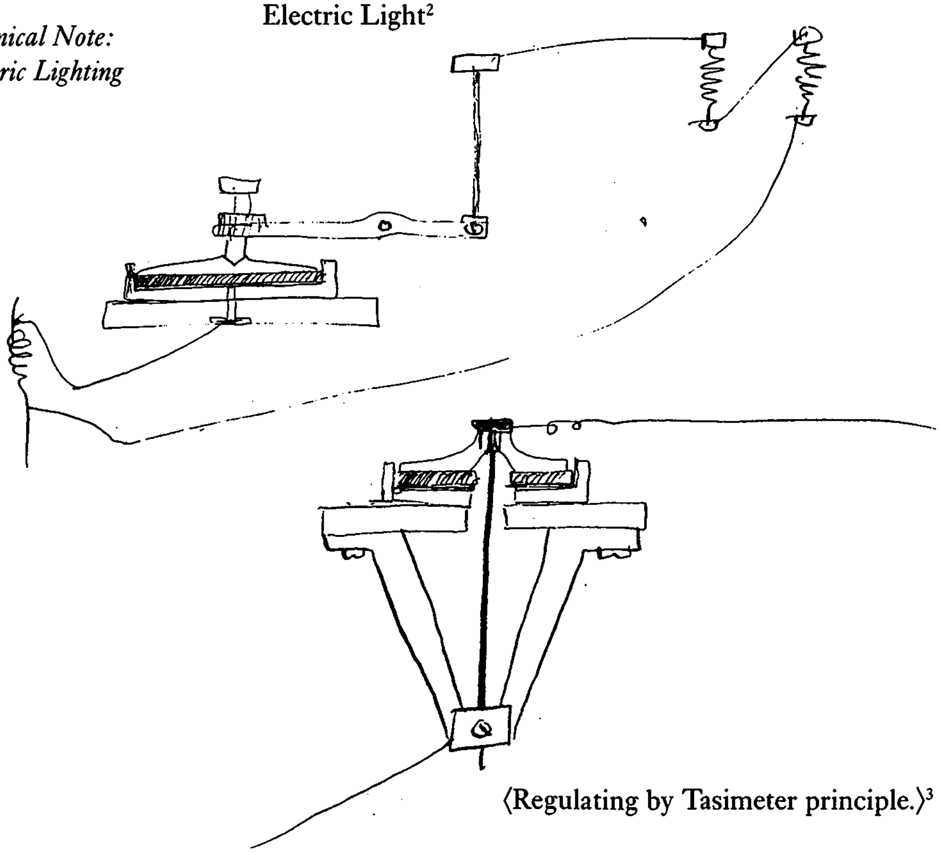
[3] Neither the clergyman nor the magazine has been identified.

-1289-

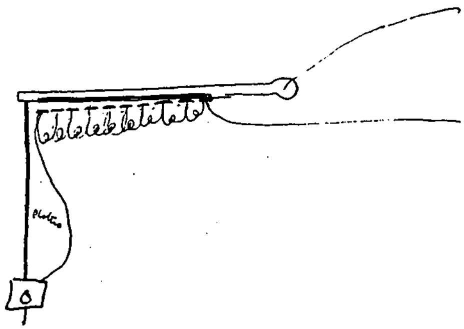
[Menlo Park,] April 14 1878[1]

Technical Note: Electric Lighting

Electric Light[2]



⟨Regulating by Tasimeter principle.⟩[3]



Thos A Edison | Chas Batchelor
M N Force | J Kruesi

X, NjWOE, Lab., Cat. 1146 (*TAEM* 6:625). Copied by William Carman in Cat. 994:116, Lab. (*TAEM* 3:227).

1. This technical note and another dated 12 May containing obscure designs are the only indication that Edison worked on electric lighting between the fall of 1877 and the summer of 1878. Several items dated January 1878 are actually from 1879 and are related to U.S. Patent 224,329, which Edison executed on 23 January 1879 (Vol. 16:1–5, Lab. [*TAEM* 4:479–87]). For Edison's 1877 work on electric lighting see Docs. 1044, 1048, 1078, 1098, and 1136.

2. Edison was thinking of using his newly discovered tasimeter principle to regulate the current in incandescent lighting elements in order to prevent their destruction from overheating. At the right of the top drawing the lighting elements are shown as coiled metal wire (probably platinum). As the elements heated and the temperature in the lamp increased, a rubber rod (the vertical piece in the middle of the drawing) expanded and pushed down on the horizontal pivoted lever, thus reducing the pressure on the carbon button at the left. As the pressure decreased, the carbon's resistance increased which reduced the current flow and allowed the lighting elements to cool. As they cooled, the process would reverse. In the other drawing the rubber rod is moved to the center of the carbon mount.

3. This explanatory note was added later by Edison; the term "tasimeter" was not used until June (see Docs. 1316 and 1329 n. 1). The first notice of the tasimeter principle appears in the *Washington Evening Star* of 19 April where Edison stated:

> Night before last I found out some additional points about the carbon which I use in my carbon telephone. It may be used as a heat measurer. It will detect one fifty-thousandth of a degree Fahrenheit. I don't know but what I can make an arrangement by which the heat of the stars will close the circuit at the proper time automatically, and directly. It is a curious idea that the heat of a star millions of miles away should close a circuit on this miserable little earth, isn't it? But I do not think that it is impossible. ["National Academy of Sciences," Cat. 1240, item 537, Batchelor (*TAEM* 94:171)]

In the following drawing, the expansion and contraction of the rubber rod, rather than changing the resistance of carbon, brings more or less resistance (the coils at top) in and out of the circuit. The text on this drawing ("platina") seems to indicate that the wire descending from the coils and possibly the coils themselves are platinum.

-1290-

Gardiner Hubbard to Thomas Watson

Washington, D.C. April 15 1878[a]

Dear Mr Watson[1]

Mr Smith[2] is here Says you should apply at once for a patent dispensing with the use of the rubber in the Edison Telephone[3]— That you better make the Edison Telephone at once taking the Scribner article & description[4] for your guide That Edison cannot use his Telephone without infringing ours—nor we his provided he gets a patent— Mr Maynard[5] has just called he heard the Edison Tel. in Philadelphia & did not think much of it altho—they thought it was the greatest instrument out. The advices I had speak in loud terms of it. I heard it ~~two~~ three weeks ago between different parts of Edison's factory & it was very loud & distinct—more clear & louder than any of ours, though no better—

Mr Smith agrees with me in saying you should lose no time in applying for a patent ~~on~~ your improvement—not as an original ~~idea~~ instrument but as an improvement—

You should spend your time experimenting & when we are reorganized, you shall be properly furnished with room & an assistant— We do not now get out of you, half you are worth—

I do hope you will improve your bells— I am yours truly

Gardiner G Hubbard

P.S. I enclose herewith trial balance please ask Mr. Devonshsire if it is correct—[6]

ALS, NjWAT, Box 1193. Letterhead of Bell Telephone Co. [a]"Washington, D.C." and "187" preprinted.

1. Thomas Watson had been a machinist at Charles Williams's Boston telegraph shop when he became Alexander Graham Bell's assistant on telephone experiments. In 1877 he became chief electrician and superintendent of manufacturing of the newly formed Bell Telephone Co. *DAB,* s.v. "Watson, Thomas Augustus."

2. Probably Chauncy Smith, counsel for the Bell Telephone Co. *DAB,* s.v. "Smith, Chauncy."

3. Hubbard had written Watson on 10 April:

> I think you told me when I saw you last in Boston, that you had sometime since tried a Telephone, discarding the use of rubber

> making it identical to the present telephone of Mr. Edison. If such is the fact, please apply for a patent at once as an improvement on the Bell Telephone & please also make a couple of telephones after this pattern that we may see how they work. [Box 1193, NjWAT]

On 17 April, Watson informed Hubbard that he had written out his patent specification and would send it with the model. Though he had been experimenting with an Edison-style carbon telephone for only a few days, Watson claimed in a 12 April letter to Hubbard that he had experimented "with plumbago without rubber and have 2 witnesses of the fact . . . Sept or Octo 1877." Both letters are in Box 1205, NjWAT; a copy of the specification is in General Manager Letterbook 1:386–88, NjWAT; see also Doc. 1302.

4. Prescott 1878a.

5. George Maynard was the Washington, D.C., agent for the Bell Telephone Co. Later in the year, Uriah Painter asked him to file Edison's patent specifications for the phonomotor. Maynard to TAE, 16 Sept. 1878, DF (*TAEM* 16:55).

6. Balance not found. Devonshire has not been identified, but was apparently a clerk at Bell Telephone Co.

-1291-

Telegrams: From/To Joseph Henry

April 16, 1878[a]
Washington D.C.

Thos A. Edison

National Academy of Science invites you to attend its meeting and Exhibit your Phonograph and Telephone on Wednesday or Thursday next. Please answer if you can come

Jos. S. Henry[1] President Academy of Science

Menlo Park NJ 8:22 PM

Prof Jos Henry

I will come if possible but will send assistant with apparatus at all events[2]

T A Edison

L (telegrams), NjWOE, DF (*TAEM* 15:530) and JHP. Both on Western Union Telegraph Co. message form. [a]Date from text, form altered.

1. Joseph Henry was director of the Smithsonian Institution and one of the elder statesmen of American science. His major research concerned electromagnetism. *DSB*, s.v. "Henry, Joseph."

2. Henry wired Edison the next day: "Telegram received shall be happy to see you" (DF [*TAEM* 15:530]). On the afternoon of 18 April, Edison and Batchelor demonstrated the phonograph and carbon telephone to the National Academy meeting at the Smithsonian Institution (see Doc. 1299). George Barker had written Johnson on 6 April that he wanted to borrow a phonograph "to show it to some friends here and also to present it before the National Academy of Science at Washing-

ton week after next" (DF [*TAEM* 15:472]). According to the *Washington Press and Union,* Barker introduced Edison and described the machines and their development ("Genius Before Science," Cat. 1240, item 535, Batchelor [*TAEM* 94:170]). On the National Academy of Sciences see *TAEB* 2:238 n. 2.

-1292-

To Uriah Painter

MENLO PARK, N.J.[a] April 16 '78

FROM THE LABORATORY OF
T. A. EDISON,
MENLO PARK, N. J.
U. S. A.

high tone[1]

U.H.P.

Your letter came late= That was a fearful "pictur"[2] I sent your point to E.H.J.[3] I expect come down Thursday= Will fix up that 5 per cent contract then.[4] This is the last of 52 letters Ive written tonight besides having sent 23 to E.H.J to answer this morning. 103 letters was the biggest mail in one day— Its getting too thin=

Edison

Autographs & Begging letters commencing to come in[5] My god how they little suspect

ALS, PHi, UHP. [a]Place from Edison's laboratory handstamp.

[1] Edison had just begun using the new laboratory handstamp.

[2] Edison is referring to his portrait that had appeared in the 10 April *New York Daily Graphic* article "The Wizard of Menlo Park" (p. 281). The photograph on which the engraving was based is classification #14.910/8 (neg. 6121B), NjWOE. Cat. 1240, item 500, Batchelor (*TAEM* 94:158).

[3] On 10 April, Edward Johnson had written Edison, "Please oblige me by sending Painter one of your good Points for his Phono I get them by fileing as you directed but can't get them made so as to work ok for me." DF (*TAEM* 15:492).

[4] See Doc. 1190 addendum.

[5] A few begging letters and autograph requests that Edison answered are in folder 78-002 in *TAEM* reels 15 and 16; unfilmed begging letters are in folder 78-002 and unfilmed autograph letters are in folder 78-006, both DF, NjWOE. Edison continued to receive such letters throughout his life.

-1293-

Charles Batchelor to James Adams

[Menlo Park,] April 16th [187]8

Dear Jim,

Yours to Edison I hasten to answer.[1] Dont leave them till you have satisfied them in every respect and get as much experimenting as you can for your own information. As regards Edmonds we can not give him a Phonograph as it is in the hands of the Stereoscopic Co. of Cheapside London, but you can do any thing you can for him as regards exhibiting yours.[2] You must go to Paris and put up the telephones in the Exhibition for Puskas. Glad you have got over first difficulty all right. Had a glorious exhibition of Phonograph at Barker's lecture at Academy of Music at Philadelphia last night[3] I showed it; and I go to Washington tomorrow to shew it to Proff Henry at Academy of Sciences. Ellen is well and all O.K. you need not worry about her We will take care of her. After you have put up the telephones at Paris you must wait there till I send you the two clockwork Phonograph's which I am making. Have sent you lots of Papers and send you two more of Philadelphia Academy last night.

I have written Ellen tonight to let her know what you are doing[4] Yours in friendship

Chas Batchelor.

ALS (letterpress copy), NjWOE, Batchelor, Cat. 1238:265 (*TAEM* 93:190).

1. Not found.

2. See Doc. 1249. Henry Edmunds had written Edison on 2 April that he was "much surprised" that Adams had not brought a phonograph for him as he had expected. He again requested a phonograph and also asked Edison to "put something else in my way as soon as you have something good—for I am sure I can introduce here for you in the best manner—both among scientific & business men." He also asked if Edison had done any work on electric lighting as "that is a subject of great importance just now." DF (*TAEM* 15:450).

3. Philadelphia newspapers carried enthusiastic reviews of the event, for which the Academy of Music had been "crowded to its utmost capacity." Over the course of two and one-half hours, Barker lectured on the physics of sound and received music and speech via telephone from Menlo Park. Batchelor also demonstrated the phonograph, which "was applauded again and again," causing him to repeat the experiment. The *Press* noted that speech received on the telephone was quite soft and "not a brilliant success" but still considered the evening a "delightfully unconventional and scientifically successful demonstration of the wonders of the telephone." "The Telephone," *Philadelphia Inquirer*, and "A Talk on the Telephone," *Philadelphia Press*, both 16 Apr. 1878, Cat. 1240, items 527–28, Batchelor (*TAEM* 94:168); advertisement, Cat. 1029:111, Scraps. (*TAEM* 25:220).

4 Not found.

-1294-

From William Kirk

Newark April 17th 1878

Dear Sir

I am in receipt of your telegram,[1] but I wish to see you. I have taken out a landlords warrant[2] on all of the machinery in Murrays place,[3] as you have not renewed your chattel mortgage[4] you will plainly see that I can sell all the machinery or enough to satisfy my claim.[5] I have not received a dollar in seventeen months from Murray with the exception of the two hundred dollars check which you gave this month[6] and yet I am not disposed to sell him out if I can make some of the payment of what is due to me. I have waited patiently for it and as I am now secure I do not wish to run any risk and relinquish my claim for the moment I lift my lien your chattel mortgage is good again I think it would be very much to your advantage to pay me and save your mortgage. I have no confidence in Murray paying those notes, and will not relinquish my claim without collateral security It is for your sake that I hold up for the present If I dont hear from you or see you I shall sell at once. I will meet you on the cars,—at New York—or at Menlo Park at any time you will state by sending me word when and where Please pay attention to this as I am tired of waiting and want my money. Very Truly Yours &c

Wm H Kirk[7]

ALS, NjWOE, DF (*TAEM* 15:531).

1. This same day Edison had telegraphed, "Is not my proposition satisfactory. I assure you that you will be paid." What Edison had suggested is not known. DF (*TAEM* 15:534).

2. A landlord's warrant provided authorization to seize a tenant's personal property in order to compel payment of back rent and, if necessary, to sell it. Black 1968, s.v. "Landlord's Warrant."

3. Joseph Murray's machine shop at 10–12 Ward St. in Newark.

4. Edison evidently remained a silent financial partner in Murray's business. The full extent of his involvement is unclear. See Docs. 1108 and 1113.

5. This same day Murray telegraphed Edison "please come see Kirk or he will sell us out he talks well but wants to meet you send me dispatch and I will pay for it as it will quiet him." DF (*TAEM* 15:533).

6. Edison had written a $200 check, which Murray acknowledged on 6 April as a loan "to be Returned as soon as possible." Murray to TAE, DF (*TAEM* 17:599).

7. William Kirk was a Newark builder and landlord. See Doc. 157.

-1295-

Thomas Sanders to Gardiner Hubbard

Boston April 18 1878[a]

Dear Mr Hubbard

Mr Watson thinks it extremely important that we secure Edison's claims to improvement on Telephone or his Telephone if it is really original.

His experiments this morning convinced him that it was a good instrument being very loud and distinct.[1]

You know what steps to take in the matter, we all advocate getting possession of the invention if we can on reasonable terms. Mr Bradly on the part of the NE[2] is equally desirous.

I hope you have made such arrangements with Mr Bradley as will be acceptable to all parties in interest— Time is precious. Yrs truly in haste

Thomas Sanders—[3]

ALS, NjWAT, Box 1193. Letterhead of Bell Telephone Co. [a]"Boston" and "187" preprinted.

[1] On 17 April, Watson had reported to Hubbard:

> In my experiments to day I succeeded in producing excellent results with the Carbon Telepone and although my apparatus was rough I got articulation twice as loud as as the loudest I have ever got from our instruments and perfectly distinct.
>
> I have written out my specification for the improvement which I will mail you tomorrow afternoon with the model. I send it to you so that you can look it over and bring it to Pollok's notice. I think it very important we should control the Carbon patent. Is it possible? [Box 1205, NjWAT]

[2] George Bradley of the New England Telephone Co.

[3] Thomas Sanders was a wealthy Massachusetts merchant who, with Gardiner Hubbard, had formed the Bell Patent Association in 1875. At this time he was treasurer of the Bell Telephone Co., a position he held until 1879. *DAB,* s.v. "Sanders, Thomas."

-1296-

Gardiner Hubbard to Thomas Sanders

[April 18, 1878][1]

I am in receipt of your favor of this date relating to Mr Edison's ~~new patent~~ Telephone I understand from Mr Edison that by his contract with the West. Union Tel. Co—It has the refusal of his inventions relating to Telegraphy either at such prices Mr. Edison may fix or[a] if that is thought too high then at an appointed value— That subject to this agreement he is at full liberty ~~to sell his inventions to any other party.~~ to negotiate with any other party in regards to these inventions.[b]

Mr. Edison I know does not intend to infringe any of Mr Bells patents, & as I understand from you this present Telephone is not an infringement; in that case & if it will work as well as your letter states I desire to purchase his invention for the Bell Tel. Co. in case the Western Union do not take it— I am prepared to offer him ~~not less than ten~~ twelve[2c] thousand dollars a year & a royalty on every Telephone made under his patents or an interest in our Co. I think we can afford to give more than other party in consequence of our command of the business of Telephones

AL, NjWAT, Box 1193. [a]Obscured overwritten letters. [b]"to negotiate . . . inventions." interlined above. [c]Interlined above, possibly by Edison.

1. This is an answer to Doc. 1295.

2. The changes made in this letter suggest that Hubbard may have shown it to Edison; the word "twelve" appears to be in Edison's hand.

-1297-

From Uriah Painter

WASHINGTON, D.C. APR 22 1878[a]

My Dr E—

How little any of us know what the morrow will bring forth! Orton had many good qualities & was a giant among pigmies at Bdwy & Dey St.[1] When he was Orton he was a kind hearted man & if he had not been worn down by the hungry stockholders would have been a different man— Now that he is gone the Prescott ring will rule. Your only friend is gone, your enemies are now rulers & it is very fortunate that your Tel'-phone was not bought—now you are free to get its value. The pecuniary sacrafice which you felt like making to help Orton need not now be done— Now you can do whatever is best for the Edisons & live up to your contract—[2]

The Photos are excellent— I will send you specimens tomorrow—[3] Brady[4] is willing to copyright them & put on the market & pay a per cent on his sales— I will try for ¼ & promise him that you will not sit for any other Photographer while he makes their ~~a~~ sale a success— I think a good many can be sold

I[b] got 3 applications today to show Phono for Churches &c! Yrs

U H Painter

ALS, NjWOE, DF (*TAEM* 15:544). [a]Place and date from *Philadelphia Inquirer* handstamp. [b]Underlined twice.

1. Painter is referring to Western Union headquarters. William Orton died around six o'clock on the morning of 22 April. On hearing the news, Edison is reported to have exclaimed, "If I get to love a man he

dies right away. Lefferts went first, and now Orton's gone, too." "William Orton's Career," *New York World,* 23 Apr. 1878, 1.

2. Painter had tried to forestall Edison's negotiations with Western Union. Shortly before Orton's death, he asked Edison "are you going to be skinned by WU?" and warned that "They say you are 'Their meat.'" Painter to TAE, 11 Apr. 1878, DF (*TAEM* 15:504).

3. While Edison was in Washington, he sat with a phonograph for formal photographic portraits at Mathew Brady's gallery; the photographer was Levin Handy. Four poses are known. A widely-reproduced one shows Edison seated at a table to the right of the machine, his hand on its crank (see Doc. 1308 n. 1). Edison is posed similarly in the other portraits. In one, also republished frequently, Charles Batchelor and Uriah Painter stand behind the phonograph, the former in the middle of the picture. In another only Batchelor appears with Edison. A second view of Edison and the phonograph alone, with his position very slightly shifted and without a decorative backdrop, has also been reproduced. Painter enclosed the photographs in a 23 April letter to Edison in which he indicated that he had arranged for more plates to be completed the following day. In a 1 May letter Painter stated he would send that evening a copy of a stereoscopic version of one of the pictures, which has not been found. Photographs 14.650/1, 14.651/2, 14.651/1 (Neg. Nos. 7001, 06424, 6521B), NjWOE; Jehl 1937–41, 157; DF (*TAEM* 15:546, 585).

4. Mathew Brady, photographer and entrepreneur, operated studios in New York and Washington. Self-consciously intent on creating a historical record of the United States in "the faces of its historic men and mothers," Brady built his reputation promoting and displaying portraits made largely by assistants. Trachtenberg 1989, 33–44, 94.

This Brady studio photograph shows Uriah Painter and Charles Batchelor with Edison and the phonograph demonstrated in Washington in April 1878.

-1298-

From James Somers

Washington D.C. Apl 22/78

Dear Sir:—

I was very much pleased to learn through an interview with you published in the "Evening Star" of this city on Friday last[1] that you had invented an improved Ear trumpet which I regard as one of the best of your many useful & wonderful inventions—

As I am myself quite deaf I am deeply interested in this invention and I am anxious to learn more of it.[2a] Will you be pleased to give me a more detailed description as to size portability &c and whether you would undertake the manufacture of one for me at an early day & what would be the probable cost? An early answer will greatly oblige Very truly yours

Jas W. Somers[3]

My deafness is of course not entire I hear thru an ordinary tube quite well— But cannot hear lectures &c

A friend of mine here also desire one—

⟨Dear Sir— I stated to the Star reporter that I had constructed & used such an apparatus to enable me to hear theatrical plays but that it would be generally impracticable owing to cumbersomeness; I am going to work soon on an apparatus to accomplish the object in a practical manner & if successful you will learn of it through the papers⟩[4]

ALS, NjWOE, DF (*TAEM* 15:34). [a]Followed by "over" to indicate page turn.

1. In the interview, which followed an account of his phonograph demonstration to the National Academy of Sciences, Edison stated, "I have invented an instrument, a sort of improved ear trumpet, with a large air chamber, and a tube which gradually decreases in size, whose end is inserted in the ear, with which I can hear perfectly well. I sat as an experiment once as far back in the theater as I could get, and yet I heard with perfect distinctness." "National Academy of Sciences," *Washington Evening Star,* 19 Apr. 1878, Cat. 1240, item 537, Batchelor (*TAEM* 94:171).

2. Somers's inquiry is one of many that Edison received about hearing aids following the *Star* interview and subsequent press reports of his work on such a device. In a 10 May letter to an "acquaintance in Chicago" which appeared in an undated newspaper clipping Edison stated: "The many letters that I have received on the subject of an apparatus for the deaf has convinced me that the demand would be enormous. So I have put two of my most skilful assistants at work testing my ideas. I feel sure that I will produce a practical apparatus within six months" (Cat. 1240, item 598, Batchelor [*TAEM* 94:197]). By the end of May, Edison had printed a circular to answer the continuing stream of inquiries. Two copies of this circular, copied by electric pen and headed "The Megaphone," are in UHP; they were sent to Uriah Painter

in July because Stockton Griffin had indicated on each that Painter would have "sole control of the above invention" (Theo. Wing to Painter, 5 July 1878; A. W. McPherson to Painter, 13 July 1878; both UHP). Written by Griffin and signed by Edison, they read:

> I have now two assistants engaged at my laboratory in experimenting upon an apparatus for the benefit of the deaf.
>
> The results so far have been quite satisfactory and I hope soon to have a practical apparatus for introduction to the public.
>
> The only drawback as yet is the large size of the apparatus.
>
> I cannot at present say what the cost will be. Your letter will be filed for future reference.

Other letters of inquiry, some of which contain marginal notes for reply, can be found in 78-001, DF (*TAEM* 15:3). Descriptions of the device are in "Ears for the Deaf," *New York Daily Graphic,* 5 June 1878, and "Edison's Ear Telescope," *New York Sun,* 8 June 1878 (Cat. 1240, items 645, 660, Batchelor [*TAEM* 94:221, 227]); see also Doc. 1361.

3. Somers wrote from the Mt. Vernon Seminary in Washington, D.C., and listed his address as 204 F St., NW.

4. On 24 April, Edison sent Somers a reply based on this marginal draft. Lbk. 3:222 (*TAEM* 28:677).

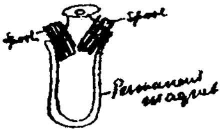
-1299-

Charles Batchelor to James Adams

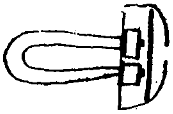
[Menlo Park, April 22, 1878?][1]

Dear Jim,

Yours received today also one to Ellen.[2] I shall send you two more transmitters this week and a box of carbons securely sealed in tin case. We have worked successfully between New York and Washington with telephones and we now fear nothing in that line. Get as much experience as you can and find out everything you can glad you came in contact with Baily[3] of the Gray Gray has now come out square and makes a regular Bell telephone in this shape[4]



with mouthpiece to talk against both diaphragms at once it is a most glaring infringement and worse than the Phelps. I showed the Phonograph at Academy of Music Monday night in Philadelphia at Barkers lecture and it was a great success, he had a pair of Dolbear telephones[5] there and they are the worst you ever saw he has a permanent magnet with two spools on and a six inch diaphragm on to talk to.



I tried to talk with Robinson[6] of W.U. at 10th & Chestnut but it was perfectly horrible I dont see how he ever expects to do any thing with such instruments as those. Edison & I have been 3 days in Washington and we showed both houses of Congress the Academy of Sciences, President Hayes and wife and many minor institutes the Phonograph and we worked telephone from Philadelphia and Menlo Park to Smithsonian Institute, Washington. Induction fearful but talking elegant.[7] I have better carbons now none of them having the gloss and I send you 50 as perhaps you may want to try some experiment [and?][a] leave with Puskas the rest. Our contracts with W.U. Tel. Co. are about complete but we have a telegram today that Orton is dead and if it affects us at all I will let you know. I dont think it will as there are other parties waiting ready to gobble it up if they show a disposition to throw us off. Edison had it all arranged for them[b] to pay us our salaries every week guaranteed for 17 years but of course this may alter things a little. If you see Jack[8] tonight or Brown[9] get all the information you can out of them for the benefit of Edison you can.

Ellen is well and was at our house when I gave her your letter she wants a letter often even if you have nothing to say Annie[10] is well & fat Mr Gallagher[11] is working at Edison's house they sent for him probably he will be able to keep it longer than most of them.

Dont leave Paris or London for home[c] before we send you word remember it is more important to find out everything than to rush home quick. I will look out for Ellen. Look out for things this week Yours

Chas Batchelor

ALS (letterpress copy), NjWOE, Batchelor, Cat. 1238:268 (*TAEM* 93:192). [a]Illegible. [b]"for them" interlined above. [c]"or London for home" interlined above.

1. This letter was almost certainly written on 22 April, the day of William Orton's death.

2. Not found.

3. Joshua Bailey.

4. Text is "Spool," "Spool," and "Permanent magnet."

5. Amos Dolbear had visited Batchelor and Barker about 12 April while they were preparing for the lecture and told them that "he had made a pair of large magnets & worked between N.Y. & Boston." Batchelor memorandum, c. 12 Apr. 1878, DF (*TAEM* 15:517).

6. Heber Robinson.

7. The demonstration of the telephone to the National Academy on 18 April consisted of Edison talking with Henry Bentley in Philadelphia. Barker also invited audience members to speak with Bentley, and

many of them reportedly did so. When the Academy resumed its normal sessions late in the afternoon the exhibition was moved to the Western Union building a few blocks away, where it continued until sundown. A Philadelphia paper explained that the induction reported by Batchelor was caused by the wires being bundled into cables across the Susquehanna and two smaller rivers. "Genius Before Science," *Washington Post and Union,* 19 Apr. 1878, Cat. 1240, item 535, Batchelor (*TAEM* 94:170); "Talking Through Space," *Philadelphia Record,* 20 Apr. 1878, Cat. 1029:7, Scraps. (*TAEM* 25:165).

The next morning Edison demonstrated the phonograph in a Senate committee room and again in a House room. According to news accounts, the Capitol exhibition lasted several hours and drew large crowds. Late that night he demonstrated it to President Hayes and others at the White House. "The Phonograph at the Capitol" and "National Academy of Sciences," both *Washington Evening Star,* 19 Apr. 1878, and "Astonished Congressmen," *Baltimore Gazette,* 20 Apr. 1878, Cat. 1240, items 537–38, Batchelor (*TAEM* 94:171–72); App. 1.G27.

8. Jack Wright had assisted Edison with his English automatic telegraph experiments. See *TAEB* 1:595 n. 5.

9. James Brown had been Edison's experimental assistant in 1872–73 and also assisted with the English automatic telegraph experiments. See *TAEB* 1:508 n. 2.

10. Unidentified; possibly a child.

11. Probably a house servant.

-1300-

From Grosvenor Lowrey

Philadelphia, April 23 1878[a]

My dear Edison

I am here in attendance upon my poor wife who is seeking strength & courage for the great trial she must undergo on Saturday next.[1]

I parted with Orton on Saturday evening:[2] & his last words to me were of you— I am sure it will gratify you to know that they were words of more than esteem,—of affection. Even in the times when we were differing[3] he had always a warm place in his heart for you, among those few who were admitted to that inner place.

I am thankful for having known William Orton. I never yet heard from his lips a thought which was not upright, noble & just. I think he was incapable of a mean thought as he was of a wrong action. It is for those of us who must look to other things than pecuniary success for distinction to cherish the memory, & spread the repute of such a man as Orton; whose qualities of head & heart should outweigh[b] all the money of Wall Street, in the esteem of intelligent men. As he spoke to me last of you, I write first to you of him Truly Yours

G. P. Lowrey[4]

Grosvenor Lowrey, Western Union's general counsel.

ALS, NjWOE, DF (*TAEM* 15:550). Letterhead of Hotel Lafayette. [a]"Philadelphia," and "187" preprinted. [b]Obscured overwritten letters.

1. Lowrey had married Laura Tryon, daughter of New York merchant Francis Tryon, in 1862. She developed a cancer in 1876 that proved to be incurable. She died in August 1879. Taylor 1978, 18, 23.

2. 20 April.

3. Lowrey referred here primarily to the conflict over rights to Edison's inventions in quadruplex telegraphy. See *TAEB* 2, App. 3; cf. *TAEB* 3:289.

4. Grosvenor Lowrey had become Edison's attorney for Western Union–related patent matters in December 1875. He was the company's general counsel, and his law firm—Porter, Lowrey, Soren, and Stone—served as its legal department. See *TAEB* 2:696 n. 2.

-1301-

From George Nottage

LONDON E.C.[a] April 24th 1878

Dear Mr. Edison

I duly received the Deeds & your letter of the 23rd Ulto.[1] & a Magazine and Newspaper since, for which accept my thanks.[2] There was something I ought to have had but only received the cover Perhaps it would be as well in future to tie the publication round with twine & write on it, instead of on a paper wrapper.

Disclaimers

It's very important you should settle these, as if any claims are bad they affect the Phono part of the patent equally with the other. Mr Preece thinks with myself that this is most essential so I hope you will give your Solicitor instructions immediately

Improvements

It is also very important you should secure these or we shall be having persons taking out Patents here for the improvements you have already invented in America which will preclude our using them—

Plate Machine

I quite appreciate what you say upon this & that it would be very unwise to bring it out prematurely. I shall be glad to receive the 2nd Instrument you promise

Clock

I shall be glad to get this so that we may send over orders for them— I do not think they need trouble themselves about excessive cheapness for a Novel article like this, we can come to cheapness afterwards. This remark will also apply to Toys —any one of which I shall be glad to see.

Instruments

I was about cabling to you to send over 200 immediately, but Mr Puskas advised me to wait till he got a manufacturer in Paris to produce them— I am waiting to be satisfied that the manufacturer can produce the right article when I shall immediately order. Mr Puskas informs me that he shall get a very superior article, many parts in Nickel Silver for $8—, or 2 Dollars each more & that the manufacturer can produce several hundreds in 3 weeks from date of order— In the meantime I have had a machine made with Clockwork, which was yesterday exhibited at the Crystal Palace[3] & I shall send it elsewhere & the Lecturers wherever they shew the Instruments will take orders for the smaller ones

If this turns out a success I shall be pleased to place a portion of the results to your credit

If the Instruments were sold outright at the present moment each purchaser could adopt this course, but would not obtain orders. I am afraid Mr Puskas is too fierce & litigious in his disposition for me to work with him satisfactorily, & as at present our relations are direct—with you & I hope they will continue so, If he be constituted your representative here & you give up your power to him I feel sure things will not work harmoniously or profitably— I have said this, because I think I heard something about his asking for a "Power of Attorney" from you—[4] I must ask you to regard this portion of my letter as perfectly private & confidential

Trusting you will not overwork your Brain & hoping soon to hear from you I am Dear Mr Edison Yours faithfully

George S Nottage[b]

LS, NjWOE, DF (*TAEM* 19:231). [a]"London E.C." preprinted. [b]"Trusting . . . George S. Nottage" written by Nottage.

1. See Doc. 1265.

2. Charles Batchelor kept a running list of press reports to be sent to various correspondents. He planned to mail Nottage copies of the April issues of *Scribner's Monthly* and *Popular Science Monthly*, containing articles by George Prescott and Alfred Mayer, respectively. He also planned to send the 18 March *Cincinnati Commercial*, which carried a biographical sketch of Edison provided by Edward Gilliland. The listed items have been crossed out and the one for *Popular Science* is also marked "OK." Cat. 1308:57–58, Batchelor (*TAEM* 90:695–96).

3. The *London Daily News* of 20 April provided an account of the London Stereoscopic Company's exhibition and indicated that A. Stroh had devised the clockwork arrangement. See Doc. 1310 nn. 3 and 5.

4 See Doc. 1237 n. 1.

-1302-

Gardiner Hubbard to Thomas Watson

Washington, D.C. April 24 1878[a]

Dear Mr Watson,

I have given the model for the Carbon specification to Mr. Pollok,[1] & asked him to attend to it.

In the Carbon Telephone of Mr. Edison, the carbon is not[b] over 1/8 inch thick.

We broke the carbon in the telephone we have into little pieces by accident & still it worked tolerably well.

It is idle to undertake to divert divert Mr. Edison's attention from the telephone, as it is exciting almost as much interest among telegraphers at present as the phonograph.[2]

He has ten or twelve men at work in his factory—about 8 on the phonograph & the others on the Telephone.[3] He has two or three assistants, each of whom have a partial interest in every invention he makes.

The small phonographs as you say are a failure.

We shall not sell any of them. I wish you could work upon them, but am afraid you have enough to do.[4] Yours Truly

Gardiner G. Hubbard

ALS, NjWAT, Box 1193. Letterhead of Bell Telephone Co. [a]"Washington, D.C." and "187" preprinted. [b]Interlined above.

1. Watson had mailed the model on 20 April (Watson to Hubbard, 20 Apr. 1878, Box 1205, NjWAT). The application (see Doc. 1290 n. 3) was filed on 25 April, and after significant modification was finally granted as U.S. Patent 245,105 on 2 August 1881.

2. In his 20 April letter to Hubbard (see note 1), Watson suggested that "It would be well to divert Edison's attention from the Telephone if possible. Perhaps it could be done by telling him how much more interest the Phonograph & Airophone is exciting throughout the world than the Telephone did etc. etc." Hubbard's reply marks a change from earlier assurances that "we need [not] fear any danger from Mr. Edison, for he is working right along with us, & thinks of nothing but the Phonograph" (Hubbard to Charles Bradley, 22 Mar. 1878, Box 1205, NjWAT).

3. Hubbard had visited Menlo Park on 23 March (see Doc. 1261 n. 2).

4. Watson reported in his 20 April letter (see note 1):

> I have received a Phonograph and after some alterations I have made it work indifferently well, as received it would not work at all. if it had gone to any one who was not a mechanic and had no tools it would have done the Phonograph Co great injury. I wish I had time to make them. I think I could do better than the present makers, but that is entirely out of the question, as matters are at present.

In a letter of the same day to Sigmund Bergmann, Charles Batchelor wrote:

> I saw one of your first Phonographs in Washington and I must say it was anything but good workmanship as the shaft had a least 1/16 of an inch play in the bearings such machines cannot be worked by inexperienced hands and I had the greatest difficulty to make it work myself. [Cat. 1238:267, Batchelor (*TAEM* 93:191)]

-1303-

To D. Van Nostrand[1]

Menlo Park Apr 25, 1878

Gents

Please send an Etymological Glossary of nearly 2500 English words in common use derived from the Greek[2] by Edward Jacob Boyce MA. Rector of Houghton Hants. London, Geo Bell & Sons York St Convent Garden 1878 Yours truly

T A Edison per Carman

L (letterpress copy), NjWOE, Lbk. 3:224 (*TAEM* 28:679). Written by William Carman.

1. D. Van Nostrand & Co. was a New York publisher and bookseller that specialized, according to its billhead, in "scientific, mining, engineering, military, and naval books." Bill of 13 Dec. 1877, DF (*TAEM* 14:311).

2. Edison's interest in the Greek roots of English words may have been sparked by the suggestion that he consider more carefully the literal meaning of the word "phonograph." John Vincent, a Methodist clergyman and co-founder of the Chautaqua movement (with Lewis Miller, father of Edison's second wife, Mina) who had visited Menlo Park, wrote on 25 February: "Now as to the Name of your instrument—it should be a 'Tautophone' and not a 'Phonograph.' It is more than a writer or recorder—it is a repeater of sound. I intend to write an article on the Tautophone. What do you think of that name?" Vincent stated in a letter two days later that he was preparing a paper on the "tautophone." (Edison had made plans with Vincent to give a lecture at Chautaqua on August 20. He was to give a "Lecture and illustrations of Electricity, the Telephone, Phonograph, Aerophone," but his summer trip to the West canceled that engagement.) Vincent to TAE, 25 and 27 Feb., 25 Apr., 12 and 13 Aug. 1878 (*TAEM* 18:925, 928; 15:555, 1052–53); App. 1.G28; *DAB*, s.v. "Vincent, John Heyl."

Probably after he received the dictionary, Edison and his assistants tried out a variety of Greek-based words as names for various of his inventions. DF (*TAEM* 14:242–45; 19:380, 449); the items on reel 14 (in 77-002) listing possible names for the phonograph probably date from this period rather than 1877.

-1304-

From William Croffut

New York, April 25—1878.[a]

Dear Mr. Edison:—

Hurrah! Your name has gone abroad among all nations—Yea, Verily! Every paper I take up is full of you—not less than

190,547 columns in American newspapers every day. Did you see my Cincinnati Commercial article?[1]

I want to get another little illustration from you for the Graphic if you will come in sometime, as soon as possible (when next in town.) (41 Park Place.)

I am delighted to state that the little phono. works beautifully. I received some friends out at Montclair[2] last Friday evening, & others up at Birmingham, Conn., (at my father's)[b] on Sat. evening, (not less than a hundred, filling three parlors)) and they all heard it & were much delighted.

The letters you wrote me have attracted as much attention as anything else & are greatly admired.[3] (It is in connection with ~~that~~ your writing that[c] I want the additional illustration.)

I hope you will be able to spare the machine without much inconvenience, as it is giving great amusement. Most Cordially Yrs

W. A. Croffut

I copy something about you almost every day=

ALS, NjWOE, DF (*TAEM* 17:84). Letterhead of The Graphic Co. [a]"New York," and "187" preprinted. [b]"(at my father's)" interlined above. [c]"your writing that" interlined above.

1. Probably "Edison, the Magician," *Cincinnati Commercial,* 1 Apr. 1878, Cat. 1031:94, Scraps. (*TAEM* 27:790).
2. Montclair, N.J.
3. Doc. 1282 was one; no others have been found.

-1305-

From Edward Johnson

New York, Apl 25 1878[a]

Dr Sir

I am informed that by granting permission to exhibit the Phonograph at a Jersey City Sabbath School free of charge— I can promote the interests of a sabbath school at Menlo Park in which Mrs Edison is interested[1] In such case It gives me pleasure to extend the permission on behalf of the "Edison Speaking Phonograph Co"[2] Yours Very Truly

E. H. Johnson Gen Agt

ALS, NjWOE, DF (*TAEM* 97:660). Letterhead of Edison Speaking Phonograph Co., E. H. Johnson, General Agent. [a]"New York," and "1878" preprinted.

1. Nothing further is known about these Sunday schools.
2. Although the company had been operating for some time, and adopted by-laws on 20 April, it had only just come into legal existence. Following extensive debate among the original investors in Edison's

phonograph patents concerning which state's laws would be most advantageous for them to operate under, the company was incorporated at Norwalk, Conn., on 24 April and the papers filed the following day. None of the incorporators were parties to the original agreement with Edison (Doc. 1190), though William Applebaugh, who was listed as company president, had been a witness to that agreement. The other incorporators were William Hayward (the only one with a Connecticut residence), Timothy Cornwell and Willard Candee (apparently assistants of some sort to Applebaugh and Charles Cheever, respectively), and Anthony Gref, Jr. (a clerk or secretary for Cheever). Their combined stock represented about one-tenth of one per cent of the nominal capital. Certificate of incorporation, articles of association, and by-laws of the Edison Speaking Phonograph Co., all DF (*TAEM* 19:62; 51:771–72).

-1306-

From Joseph Murray

Newark, N.J., April 29th 1878[a]

Sir

Newark Bord of Trade & Several other Gentlemen friends will visit your laboratory on Thursday May 2nd at 3—Oclock on especial car and will be pleased to see you[1] Hon W. H. Kirk will be one of the party. do pray for him on Phonograph on that ocasion as he needs it very much— oblige Yours truly

J T Murray

many thanks for the notes & check[2] he dont want machinery moved till notes are paid but will make Rent $360 per year with Power[b]

ALS, NjWOE, DF (*TAEM* 15:571). Letterhead of J. T. Murray. [a]"Newark, N.J.," and "187" preprinted. [b]Followed by centered horizontal line.

1. On 25 April, Murray had written Edison that "several of the first citizens of Newark" had asked him to arrange a visit to see Edison's laboratory and "the Great Ex Newarker who they all seem delighted with" (DF [*TAEM* 15:554]). One hundred thirty-four members of Newark's Essex Club visited Menlo Park on 2 May. Afterwards, Murray reported to Edison that the "visitors were delighted with your entertainment and several of them came to me and asked me if you could be induced to return to Newark" (Murray to TAE, 3 May 1878, DF [*TAEM* 15:602]). Accounts of the visit appeared in the Newark newspapers the following day ("Edison's Phonograph," *Newark Daily Journal;* "A Call upon the Phonograph," *Newark Daily Advertiser;* "Edison's Machine," *Newark Morning Register,* Cat. 1240, items 572, 574–75, Batchelor [*TAEM* 94:191–92]).

2. Edison gave Murray a $250 check for rent on 26 April. In a 4 May summary of his debts Murray also acknowledged Edison's notes to William Kirk for one, two, and three months. Murray calculated that Edison had loaned him $1,100 to pay the landlord, who, he reported, was

"determined to have it— after all the rent he received from us I supposed he would be easy with me." He also asked whether Edison had "any work for me to do I should like it I am near busted" (Murray to TAE, 4 May 1878; see also bank notes and related correspondence, all DF [*TAEM* 15:604, 17:601–9]). A list of Edison's notes to William Kirk is in Cat. 1185:376, Accts. (*TAEM* 22:703).

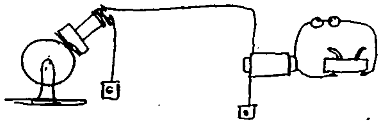
-1307-

Notebook Entry: Telephony

[Menlo Park,] April 29th 1878

Is the sound on the telephone receiver produced by rarefaction and condensation, or by vibration of the diaphragm?[1]

Experiments to find out something definite in regard to the above:



1 This experiment was the placing a telephone receiver on the mouthpiece of the phonograph from which with our loudest talking we could not[a] get an indent on the tinfoil

2 I took the spool and core out of receiver and also mouthpiece out of the phonograph, and then fixed the core and spool so that it acted directly on diaphragm of phonograph the core only being $1/50$ of an inch away from it with this device we could not get anything at all. This shows that the indents (if any are made by vibration) are infinitely smaller than those produced by the music box[2] although you cannot detect even them with a magnifying glass of ordinary power It may be that the action of the magnet core had something to do with the dampening of the diaphragm so as not to leave it free to work.

Chas Batchelor

X, NjWOE, Batchelor, Cat. 1317:57 (*TAEM* 90:685). Written by Batchelor. [a]"we could not" repeated on next line following drawing.

1. See Doc. 1251 n. 3.

2. In a February experiment Batchelor had used a music box to show that indentations small enough to be visible only under a microscope could generate recognizable sounds. See Doc. 1188 n. 2.

-1308-

From Uriah Painter

W[ashington]— 4-29-30 [1878]

My Dr E

I enclose you two more Photo's— How do you like them?[1] I have promised Brady that you will not sit to anyone else at present & give him a chance to keep poor pictures out of the market! He sends 50 to Johnson to-morr & 50 more daily for few days. I can secure you a royalty of 25 pr ct on their sale which will count up fast= If you dont let others [-][a] "take" you— one man estimates 100,000 will be sold this summer— I am going to ship lot to London & Paris in few days[2]

We put the Phono' into stock Co Satdy at $600,000 You get $30,000 of it,[3] & we have an ~~order~~ application for some of it at 50 cts on dollar—[4] If the stock is going to be good your receipts will be immense![b]

We expect to arrange for 1000 public exhibitions in next 90 days! It grows daily! I sat by C[harles] A Dana Satdy night in Johnsons show[5] & helped fill him up! He has it now bad! Is coming out to see you!!

Was sorry to miss you Satd'y, was busy helping organize & push Phono' biz' all day!

Brady was with Barnum on "Tom Thumb,"[6] & made 150,000 photo's[c] for him of Tom! so you see he understands it—Will send you large one framed Wednesday—[7]

I think the side one is superb. Johnson was very much pleased with[d] it, says this is the first picture of Edison he has ever seen—

How is ~~P~~ Tlephoe? Stager told me Satdy that Phelps has the big thing now! Beats all the rest— Loudest sound ever obtained— In a box! big magnet! big disk! big thing & more such rot!

There is no doubt but that Prescott ring are now dominant! Twombly was sat down[c] on by all hands—[8]

Got the extension you wanted this am—& so wired you—[9] Yrs

U H Painter

Did you see Sunday's Herald? They fell into line![10] UHP

ALS, NjWOE, DF (*TAEM* 15:575). [a]Canceled. [b]Underlined twice. [c]Obscured overwritten letters. [d]Overwrites a "—."

1. The only known Brady photographs are those mentioned in Doc. 1297 n. 3, though there may have been others. On 23 April, Painter had indicated that he was sending Edison two copies of the "best of all the plates." DF (*TAEM* 15:546).

2. In a 1 May letter to Edison, Painter reported that Brady had printed and was about to send 200 copies of one or more of the pictures to London and Paris (DF [*TAEM* 15:585]). Nothing further is known about the envisioned royalties from domestic or foreign photograph sales. However, an Edison Speaking Phonograph Co. circular issued by James Redpath to prospective exhibitors indicated that George May-

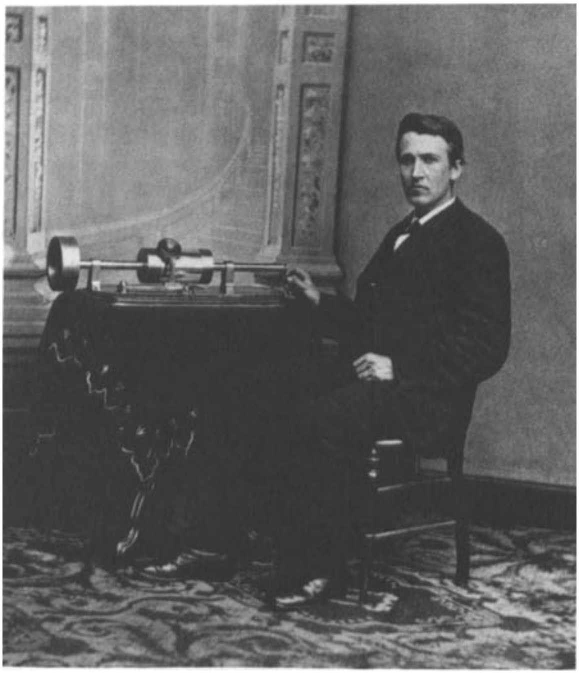
nard of Washington, D.C., could supply "photographs of Edison in different sizes, made by Brady." The circular also indicated that A. S. Seer, a New York "Dramatic Printer," had "a handsome Three Sheet Poster with a portrait of Edison, and attractive Window Cards, specially made for Phonographic Exhibitions" (UHP). It is not known if these were Brady photographs.

In late May, Redpath wrote Painter on behalf of the phonograph company to request that he take over the Brady photograph business, telling him that "you will do better in selling the photos than any one here because every one has more than they can do, not least all that they ought to attend to." The company proposed to send Painter a list of phonograph agents to assist his efforts. There is no evidence, however, of any subsequent effort by Painter or others to sell these photographs. Redpath to Painter, 23 May 1878, ESP Lbk. 2:74; Charles Cheever to Painter, 23 May 1878, ESP Lbk. 1:306–7; both UHP.

3. That Saturday was 27 April. Though Doc. 1190 only required a $50,000 investment, the new Edison Speaking Phonograph Co. had a capital stock of $600,000. However, only twenty-five shares at $25 per share (a total of $625) had been paid in at the time of incorporation (Edison Speaking Phonograph Co. certificate of incorporation, DF [*TAEM* 19:62]). For the disposition of the other 23,975 shares (with 1,200 for Edison and 4,400—the largest holding—for Painter) after the January partners formally signed their rights over to their corporation, see Charles Cheever to Gardiner Hubbard, 16 May 1878, Box 1205, NjWAT. The agreement among the five partners of 23 May 1878 and an undated memo showing phonograph stock shares are both in UHP.

4. Nothing is known of the prospective purchaser.

5. Johnson was exhibiting the phonograph nightly at artist William



A Brady studio photograph of Edison and the phonograph, marketed in the spring of 1878.

Kurtz's gallery on Madison Square and the Edison Speaking Phonograph Co. was planning to license exclusive exhibition territories throughout the United States. By mid-May the company was training eighty men who had each paid $100 for the right to exhibit the phonograph. They were to charge twenty-five cents admission for their exhibitions with the company getting twenty-five percent of the gross receipts. Edison got twenty percent of the net receipts of these exhibitions, which continued through October. He received a total of $1,031.91. Advertisement, Cat. 1031:91; "The Phonograph's Last Device," *New York World*, 17 May, Cat. 1029:68, both Scraps. (*TAEM* 27:789; 25:195); agreement between Ezra and Robert Gilliland and the Edison Speaking Phonograph Co., 31 May 1878, UHP; Edison Speaking Phonograph Co. royalty statement for December 1878, DF (*TAEM* 19:204); see also Docs. 1314 n. 4 and 1326.

6. Social philosopher Phineas T. Barnum was one of the most successful and innovative producers of popular entertainment in the nineteenth century, specializing in spectacles, hoaxes, and a circus. "General Tom Thumb" was the stage name of Charles Stratton, a midget who was a major attraction at Barnum's American Museum in New York. *DAB*, s.vv. "Barnum, Phineas Taylor," and "Stratton, Charles Sherwood."

7. 1 May; no such photograph has been found.

8. Businessman Hamilton McKown Twombly was an investor and manager in many companies, primarily in the railroad industry. He married Florence Vanderbilt, daughter of William H. Vanderbilt, in 1877. After the death of Cornelius Vanderbilt the same year, Twombly was extensively involved with his father-in-law in the handling of that family's fortunes, including its substantial ownership of Western Union, where both served on the Executive Committee. At this time Twombly was in charge of Western Union's telephone business. Twombly's middle name was often abbreviated as "McK." and he was often referred to as "Hamilton McKay Twombly." *NCAB* 30:17; Western Union 1877; TAEB 3, App. 1.G18.

9. Not found.

10. Painter is probably referring to the fact that on 28 April the *New York Herald*, like other newspapers on or near that date, devoted considerable space to reprinting and praising Edison's article on "The Future of the Phonograph." See Doc. 1283 n. 1.

-1309-

To Uriah Painter

MENLO PARK, N.J.[a] April 30—78[1]

U.H.P

I will not have any other photographs taken if Kurtz[2] does the right thing— am glad you are getting the Co organized on some basis. The W. U. have scooped me, but it will turn out right for us all. Prescott if he plays any shines on me may get tipped up. The phonograph I have here brings out everyones voice as well as mine so that removes a small weight from my mind. The electrotyping is a perfect success. Yours

T.A.E

ALS, PHi, UHP. [a]Place from Edison's laboratory handstamp.

1. This appears to be an answer to Painter's letter of the same day (Doc. 1308).

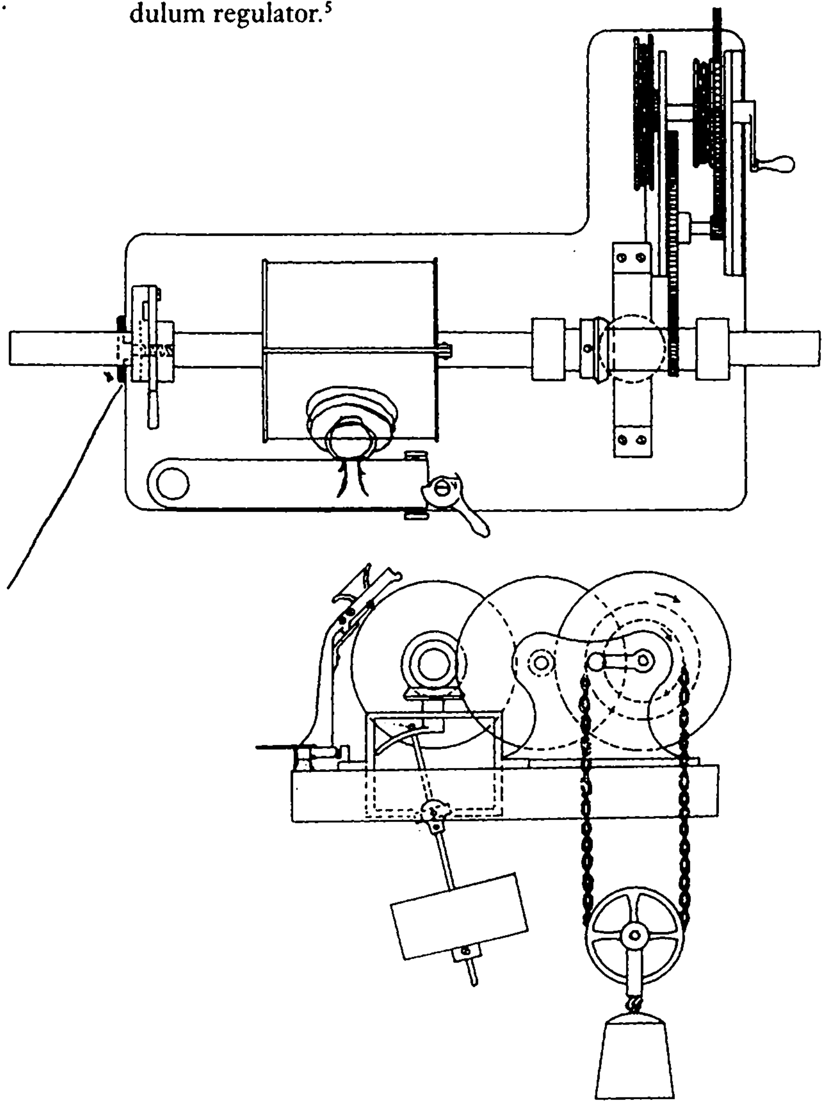
2. Painter noted in a 1 May reply that Edison meant the photographer Brady rather than the portraitist William Kurtz (DF [*TAEM* 15:585]; Wilson 1878, 788). Kurtz had a gallery on Madison Square. He had written Edison on 20 April asking him to sit for "a large picture (Crayon) of you for my Gallery" (DF [*TAEM* 15:543]). Edison had replied the same day that he would call upon Kurtz at "the earliest opportunity." (Lbk. 3:218 [*TAEM* 28:673]). It is not known if he did so.

-1310-

Technical Note: Phonograph[1]

MENLO PARK, N.J.[a] April 30th 1878[2]

Edison's Speaking Phonograph[3] with clockwork[4] and pendulum regulator.[5]

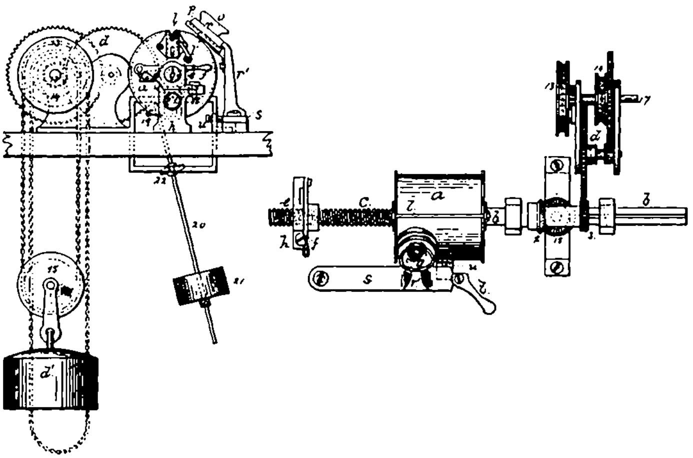


The top of this bearing for shaft is made adjustable sideways so that if the point on diaphragm is not quite opposite groove on cylinder by turning thumb nut x it will move the cylinder, shaft on top of bracket bodily sideways—[6b]

Chas Batchelor

X (copy), NjWOE, PS, Caveat Drawings (*TAEM* 8:897). Written by Charles Batchelor. Document is a tracing, probably made by William Carman. [a]Place from Edison's laboratory handstamp. [b]Paragraph connected by a line to "x" on drawing.

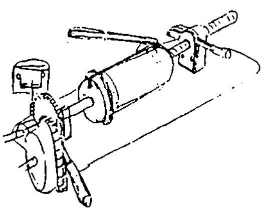
1. This document is on one of three sheets of tracings of draft drawings labeled "Caveat 80" by William Carman. Edison did not include the drawings from this document in his filed caveat (Doc. 1341), but did use detailed versions of them in his September patent application (Case 154, figs. 1 and 2). Another tracing, of 11 April drawings by Charles Batchelor, was probably also part of this group. Caveat Drawings, Patent Drawings, both PS (*TAEM* 8:898–99, 749); patent application, Case 154, DF (*TAEM* 18:747); Vol. 17:75, Lab. (*TAEM* 4:942).



Detailed drawing of Edison's clockwork-driven cylinder phonograph from his patent application, Case 154.

2. This machine had been in the works for several weeks before Batchelor made these drawings. He had written on 16 April of making two clockwork-driven phonographs, at least one of which was completed by 19 May. TAE to New Jersey Steel and Iron Co., 29 Mar. and 3 Apr. 1878, Lbk. 1:478, 487 (*TAEM* 28:324, 332); Henry Davies to TAE, 6 Apr. 1878, DF (*TAEM* 18:975); Vol. 17:61, 63, 73, 75–76, 78–80, 82–83, Lab. (*TAEM* 4:927, 929, 940, 942–43, 945, 947, 949, 951–52); Docs. 1293, 1317, 1332; see also TAE to Clarence Blake, 21 May 1878, CJB.

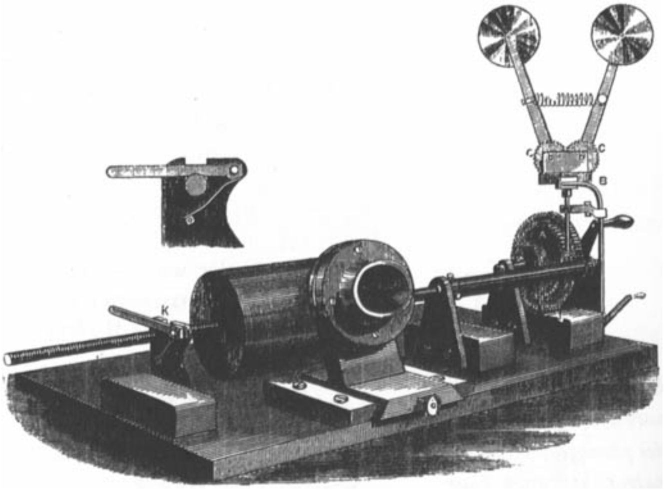
3. Aside from the clockwork and the adjustable bearing (see note 6), this phonograph incorporated two significant improvements. First, instead of being glued, the ends of the foil were held in place by a metal bar pushed into a longitudinal groove. This design first appeared in a sketch of 19 March. Second, the bearing at the threaded end of the shaft (away from the clockwork) was designed to release the shaft so that the cylinder could be slid back to its starting position, rather than cranked



The 19 March drawing of Edison's clockwork-driven cylinder phonograph.

backwards. This also showed up in the same 19 March sketch. The mechanism drawn there strongly resembles the release shown on the clockwork phonograph of the English instrument maker Augustus Stroh, which Stroh had built in February and which was illustrated in the 8 March issue of the English journal *Engineering.* Vol. 17:61, Lab. (*TAEM* 4:927); "The Phonograph," *Engineering,* 8 Mar. 1878, Cat. 1240, item 449, Batchelor (*TAEM* 94:138).

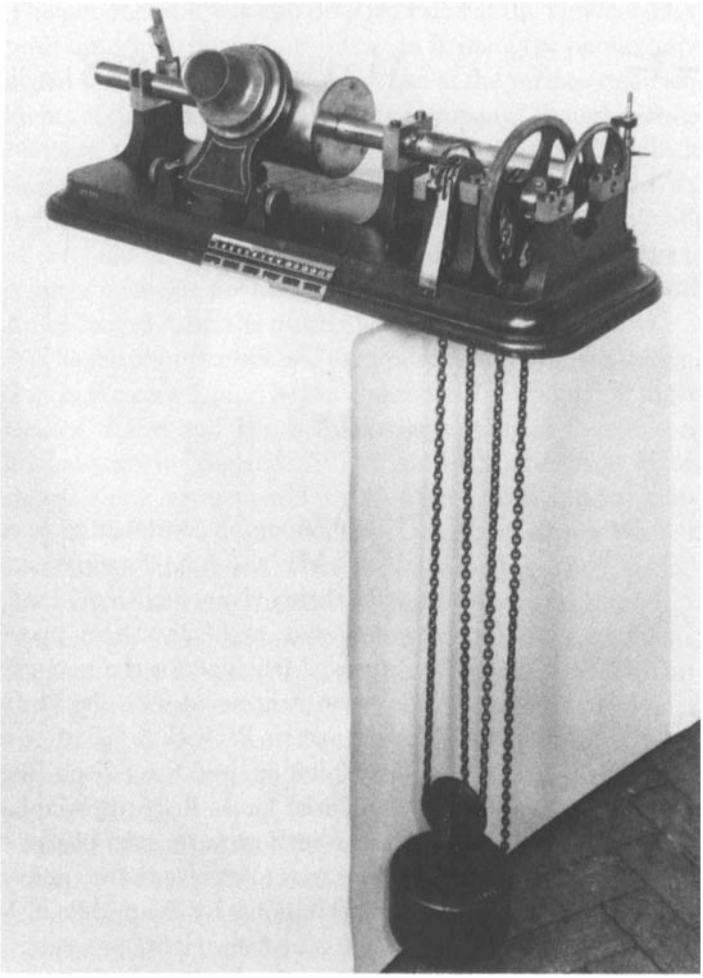
Augustus Stroh's clockwork phonograph, from the 8 March issue of Engineering.



4. Edison had intended to apply a clockwork to his cylinder phonograph since its inception and had succeeded to some extent in February (see Docs. 1147, 1153–54, 1174, 1199, 1200, and 1204 n. 3). The arrangement of the weight and chain, invented by Christiaan Huygens in 1660 and known as "Huygens's maintaining principle," was common on weight-driven machinery such as European Morse telegraph registers (Knight 1877, 569; "The Phonograph," *Engineering,* 8 Mar. 1878, Cat. 1240, item 449, Batchelor [*TAEM* 94:140]; Prescott 1877, 484, 486). Batchelor had drawn it in 1874 (*TAEB* 2:292). It allowed the operator to wind up the weight without disturbing the running clockwork. The specific type of chain Edison wanted was not readily available and he had to have it made to order (TAE to New Jersey Steel and Iron Co., 29 Mar. and 3 Apr. 1878, Lbk. 1:478, 487 [*TAEM* 28:324, 332]; Henry Davies to TAE, 6 Apr. 1878, DF [*TAEM* 18:975]).

5. The pendulum, to the left of the hanging weight, is a conical (rather than oscillating) pendulum—that is, the weight moves circularly. At this time conical pendula were used in telescope drives and Hughes printing telegraphs (Knight 1877, 1661; Prescott 1877, 619, 628–29). Batchelor first drew a conical pendulum on 15 February. The design reappeared in a series of drawings beginning on 9 April and was included in Edison's 29 May caveat (Doc. 1341, figs. 64–66) and his 16 September patent application Case 154 (Vol. 17:53, 66–67, 72–74, 76–77, 80, 82, 95, 105, 108, 114–15, Lab. [*TAEM* 4:920, 932–33, 938–41, 943–44, 949, 951, 964, 972, 975, 980–81]; Caveat Drawings, Patent Application Drawings, both PS [*TAEM* 8:898, 749]; patent application, Case 154, DF [*TAEM* 18:747]). Clockwork phonographs made in Eu-

A weight-powered clock-work-driven tinfoil phonograph.



rope by Stroh and Edme Hardy employed fan governors rather than pendula. A representative Stroh phonograph is in the Science Museum, London (Inv. 1929-283); one made by Edme Hardy, now in the collection of the Musée National des Techniques, CNAM, Paris (Inv. 9364-0000), is pictured in Charbon 1981 (p. 64).

6. Batchelor first drew this adjustment on 11 and 12 April. In mid-August he replaced it with adjusting screws at the base of the mouthpiece. Vol. 17:75, 78, 136–38; Lab. (*TAEM* 4:942, 945, 1000–1002).

-3- May–June 1878

The phonograph continued to occupy much of Edison's time during May and June. Fascination with the invention continued to bring visitors to Menlo Park, including reporters from out of state, and Edison took up the challenge to develop an improved machine for the new exhibition business. Edward Johnson contracted with the Philadelphia telegraph instrument makers Partrick & Carter to manufacture phonographs for exhibition, and the Edison Speaking Phonograph Company hired James Redpath, who had been running a lyceum bureau in Boston, to take charge of its exhibition agencies. Edison was to receive twenty percent of the net receipts from the exhibitions. By the middle of May, the company had begun to train some eighty prospective exhibitors to operate the phonograph. Among the new exhibitors was Edison's old friend and former partner Ezra Gilliland.[1]

The difficulty of operating the exhibition phonograph, which made it necessary to train exhibitors, was one of the problems that led Edison to begin work on an improved model. By early June, he had developed a new design and built a prototype. He then contracted with Newark manufacturer Alex Pool & Company to build ten of these "new hand" phonographs, though he and Batchelor would make some further modifications before these were finished in July. The most significant improvement, a larger and heavier flywheel that allowed operators to turn the cylinder at a more uniform speed, also began to be incorporated into some of the existing exhibition machines sometime in June.

Phonograph exhibitions were also taking place in Paris, where Theodore Puskas showed it "four or five times a day."[2]

The phonograph was also demonstrated at the Universal Exposition, which opened on 1 May. In Britain, the phonograph began to be "exhibited daily in action at the various establishments of the London Stereoscopic Company," though George Nottage, the company's manager, disputed Edison's right to share in exhibition receipts.[3] Edison himself retained the rights to the phonograph and telephone for countries outside of the United States, Canada, and Europe, and he began to arrange agencies for these inventions in Central and South America and Australia during May and June.[4]

The telephone continued to require some of Edison's attention as Western Union began commercial introduction in the United States and James Adams and William Preece conducted tests in England. At the end of May, Edison finally signed a new agreement with Western Union and the company ordered five hundred carbon telephones from Western Electric in Chicago and from its own New York shop, though the carbon buttons themselves would be manufactured at Menlo Park.[5] Western Union planned to introduce the Edison telephone on its new "Merchant's Exchange," which connected "express, steamship, railway and other companies, merchants, lawyers, banks and private individuals by means of private lines with a central office, and through that office with each other."[6]

While Western Union's tests proved successful, the same could not be said of those taking place in England. There the extensive use of underground lines proved troublesome, though Edison's transmitter was clearly superior to Bell's in comparative tests. The Bell Telephone Company, however, had a strong patent position on receiver technology, and Edison set his nephew Charley to work experimenting with alternative receiver designs. Edison also revived the idea of using an electromotograph receiver. In the meantime, he continued to use Bell-style receivers in the telephone sets that he ordered from Partrick & Carter for use outside of the United States.

The fate of the carbon transmitter in Britain was profoundly affected by a controversy that erupted at the end of May when Edison charged that William Preece, whom he considered his agent there, had colluded with telegraph inventor David Hughes to steal his claim to the discovery that carbon and other semi-conductors varied their resistance under pressure. Hughes made this claim in association with his development of the microphone, but Edison felt that Preece should have set forth Edison's claim to this discovery in connection with his telephone experiments of 1877. To add insult to injury, Hughes also claimed the discovery of this principle for measuring heat, even though Edison again claimed priority as a result of his April announcement of the heat measurer he soon named the tasimeter. To the chagrin of Preece and the British scientific community, Edison initially chose to stake his claim through a letter published in American newspapers in early June. Newspapers and scientific and technical journals on both sides of the Atlantic were soon taking sides and publishing opposing accounts of the controversy. Edison completed his break with Preece by giving charge of his telephone in Britain to George Gouraud, who had been connected with promoting his automatic telegraph there a few years earlier.

Besides working on the phonograph and telephone, Edison found time to experiment with some of the new devices he had conceived earlier in the year, including the aerophone, phonomotor, and megaphone. He set two men to work on the new hearing aid, which he began to call the "auriphone." Edison and Batchelor also developed his tasimeter into what Edison believed to be a practical scientific instrument. Another project commenced at the laboratory in early May, when machinist John Ott, who had worked in Edison's Newark shops, was hired by the partners in the toy phonograph contract to develop an instrument under Edison's direction. Finally, Edison considered joining Patrick Kenny, the former superintendent of Gold and Stock Telegraph Company's manufacturing shops, to develop a facsimile telegraph, a technology he had first worked on in the late 1860s.

Also joining Edison at Menlo Park was Stockton Griffin, an old telegraph associate who became his personal secretary at the beginning of June. Griffin's hiring was probably precipitated by the large amount of correspondence, as well as the continuing stream of visitors (including organized groups from Newark and Boston), with which Edison had to cope as a result of his new-found fame.

Amidst all the demands on his time, Edison took a moment to observe the transit of Mercury on 6 May with a telescope he borrowed from instrument maker Asahel Eaton. His longtime interest in astronomy also led Edison to accept an invitation from Henry Draper to accompany one of the scientific expeditions being made to the western United States to observe the solar eclipse scheduled to occur in late July.

With steady income guaranteed by his new agreement with

Western Union and from phonograph exhibitions, Edison offered to pay for a trip to Europe for his father, though Samuel did not go at this time.[7] He also decided to purchase a handsome team of ponies from the Brooklyn Riding Academy.

1. Docs. 1308 n. 5, 1334 nn. 1–2, and 1326 n. 5.
2. *Paris Advertiser,* Cat. 1029:60, Scraps. (*TAEM* 25:191).
3. *Teleg. J. and Elec. Rev.*, 15 June 1878, Cat. 1030:18, Scraps. (*TAEM* 25:265).
4. Docs. 1317 n. 2 and 1328 n. 6.
5. Doc. 1342 n. 1.
6. See Doc. 1332 n. 4.
7. Doc. 1330 n. 1.

-1311-

To Clarence Blake

MENLO PARK, N.J.[a] ~~April 30,~~ May 1 1878

Friend Blake.

Your two letters[1] were sent to Newark and just reached me; The machine you have is an extremely poor one and very slight changes improves or destroys the articulation. The shake & grinding noise in the bearings are recorded= On my machine here I have hardened steel rings (polished)[b] in which the shaft runs, consequently with very smooth foil the noise is slight. This morning I recorded "Mary had etc" 16½ feet from the instrument. The articulation is all that I want= If I can always make machines that will articulate so a person can[c] readily read an article read backwards previous to his hearing it as this machine does I shall be satisfied= The tone is more natural if the delivering funnel is not used=[2] Previous to the appearance of prof Jenkins article I had tried repeating words backward as well as music, many songs are melodious= Jenkins statement that .A. ~~sounds~~ & other letters reproduced backwards are the same is not correct and cannot possibly be so although they sound somewhat[c] alike= I have never noticed that an increase of speed destroyed the articulation. I think that it merely raises the pitch. This to me knowing nothing of Helmholz V.T.[3] is a self evident proposition. To be sure I tried an experiment a few moments ago I sent my assistant away and spoke the following letters A L G U M E X I B O D U. on his return to the room I repeated it at about[c] twice the speed and he gave me the letters on the 2nd trial[b] he said If he could have remembered them he could have told them the first time. Now if these letters sounded different I do not see how he could have recognized them. Your rubber experiment[4] is new to me; I have used gutta percha & paper under foil but not rubber tightly stretched= What you want is one of my new clockwork cylinder machines with adjustable pendulum bob—You could then go for the Acousticians. If I fix up one for you here, how would you like to spend a few days here in making some scientific investigations in Sound—[5] I shall never do it. I have been thinking much about the phono disc & the complicated organ of the ear and I have reached this conclusion ie[d] that the complicated apparatus of the ear is more especially designed to ~~anylize~~ analize clang sounds & that ferrotype discs are quite sufficient for sounds ~~that~~ whose vibrations follow each other with some regularity= but is a poor instrument for analyzing single vibrations as in the knocking of sticks where the sound is made by an enormous number of single vibrations not series—[6] more anon—Yours

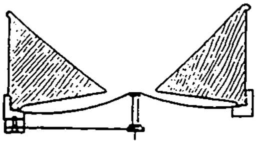
T A Edison

ALS, MB, CJB. [a]Place from Edison's laboratory handstamp. [b]Obscured overwritten letters. [c]Interlined above. [d]Circled.

1. Blake had written Edison on 29 and 30 April. DF (*TAEM* 92:334, 337).

2. Edison was responding to Blake's 30 April letter (see note 1) discussing his experiments with a small hand-crank phonograph obtained from Thomas Watson. The same day Blake had also written to Watson concerning these experiments (Box 1205, NjWAT).

3. In his 29 April letter (see note 1), Blake had disagreed with Fleeming Jenkin's and J. A. Ewing's challenge to Hermann von Helmholtz's theory of vowel sounds. Essentially, Helmholtz claimed that a fundamental tone unique to each vowel determines the distinctive sound of that vowel. Were this theory correct, mechanically raising the pitch of a vowel on the phonograph would produce an entirely different sound. Jenkin and Ewing claimed that reproducing vowel sounds at different speeds from those at which they were recorded changed the pitch but made "no alteration in the quality of the sounds." Jenkin and Ewing 1878a; Jenkin and Ewing 1878b (Cat. 1031:70, 104, Scraps. [*TAEM* 27:773, 797]); *DSB*, s.v. "Helmholtz, Hermann von."



Edison experimented with a diaphragm like this design by Clarence Blake.

4. In his 29 April letter (see note 1), Blake reported that "By covering the cylinder with a layer of very thin pure rubber tissue and putting the tin foil on top of that I find that in addition to distinct articulation I can get a better reproduction of the s, sh, and ch, sounds." Sometime after this Blake wrote to William Preece about his phonograph experiments, including those with rubber, noting that the latter "was new to Mr. Edison, and has since been repeated with like success" (Preece 1878c).

5. Blake visited Menlo Park on Sunday, 26 May. Blake to TAE, 24 and 28 May 1878, DF (*TAEM* 15:694, 18:1010).

6. In his letter to Preece, Blake indicated that he had attempted to solve this problem by constructing "a diaphragm upon the principle of the human drum membrane." He found a curved membrane used as a

phonograph diaphragm reproduced the human voice "without the sharper over-tones, with much more natural and agreeable quality and with more than double intensity." Blake also stated that Edison was conducting his own experiments with a diaphragm of Blake's design. See Preece 1878c.

-1312-

To Asahel Eaton

Menlo Park NJ May 1, 1878

Prof Eaton

If possible have telescope here by the 5th[1] If you cannot let me know at once as I must get another one at once Yours truly

T A Edison pr Carman

L (letterpress copy), NjWOE, Lbk. 3:228 (*TAEM* 28:683). Written by William Carman.

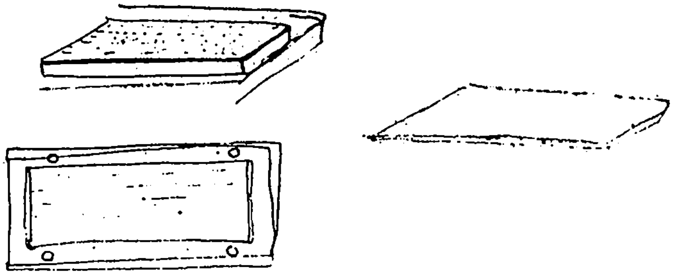
1. Edison planned to observe the transit of Mercury on 6 May. Eaton wrote on 4 May that the telescope Edison had ordered was not ready and he was sending a three-inch telescope with appropriate eyepieces instead. This was an unfinished but functional telescope, "a much better instrument" for this purpose. Eaton wrote again on 25 September that he had not yet completed Edison's six-inch telescope but offered to finish the smaller one sent in May. DF (*TAEM* 15:607, 16:144); "Notes," *Nature,* 17 (1877): 69.

-1313-

Technical Note: Phonograph

[Menlo Park,] April 31 [May 1?] 1878.

Duplicating phonographic Records



After many experiments we have concluded that of all the methods tried that the following two are the best=[1] A plate the size of the sheet has grooves planed in it corresponding to the thread on the cylinder or plate. on this plate is laid a sheet properly indented, the raised dots downward in the grooves— a frame fits of this like the printers use for locking up ~~cpy~~ type forms[2] This frame extends ½ ~~and~~ or 1 inch above the record the foil is gummed to the grooved platen ~~the best plaster~~ over this frame is a plate with a funnel shaped orifice & into this is poured the best plaster pari~~r~~s= after its set its turned upwards the foil taken from it & its then placed under a press whose piston is proved with a platten equal in size to the sheet this platten is of polished metal. four pins are on the frame holding the Paris, these are the registering pins over which the paper frame having the foil to be indented is placed, a sheet of gutta percha foil or other non fibrous material is laid on the foil & the press platten brought down ~~f~~ & forces the foil on the raised dots of the paris thus taking an accurate copy

The other plan is to substitute an electrotyped peice of Copper for the paris—[2]

T A Edison Chas Batchelor
J Kruesi M. N. Force

X, NjWOE, Lab., Vol. 17:84, 10 (*TAEM* 4:953, 880). Document multiply signed. [a]"Duplicating phonograph records continued" follows at top of second sheet.

1. Other approaches, probably from before this date, are included in Edison Caveat 80 (Doc. 1341 [figs. 60–62]).

2. The day before, Edison had written Painter, "The electrotyping is a perfect success" (Doc. 1309). The first experiments in this process were conducted by William Hollingshead, a New York electrotyper. Hollingshead had seen Edison's phonograph during the New Year's exhibitions at Western Union, where he acquired a tinfoil recording. After making a matrix from the foil, he used deposits of copper to make electrotype duplicates of the recording. The deposits, which varied in depth between .004 and .0312 inches, "were exactly like the original tin foil having every scratch or mark faithfully reproduced thereon." Hollingshead accompanied Joseph Moody to Menlo Park on 23 February and gave a piece of the copper record to Edison, who was "pleased that there was a possibility and certainty of preserving and duplicating any records made on tin foil or otherwise." Hollingshead never returned to Menlo Park but was "informed that steps were immediately taken to exploit my method of obtaining reproduction from tin foil records." Hollingshead's deposition, pp. 11–12, *American Graphophone v. Leeds & Catlin;* Wilson 1878, 655; Cat. 1233:54, Batchelor (*TAEM* 90:80).

In June, Charles Cheever suggested to Gardiner Hubbard that they take "some active steps . . . in regard to perfecting arrangements for Stereotyping the Matrices, there have been several Stereotypes made of it, but they have all been reported to me as not reproducing well when placed upon the machine." He felt that "Edison is so very busy between the visitors and his experiments that I fear that much valuable time will be lost unless we take outside means for getting at this part of the thing." He therefore suggested "appointing a few people say a half dozen who would like to experiment with the same furnishing them each with a

Phonograph at cost price and offering a prize of a Thousand Dollars to the one who within the next two months shall produce the best result, no prize to be given unless such best one works in a satisfactory manner." He also indicated that the "Toy people" were interested in sharing the cost of these experiments. Nothing appears to have been done in this matter. Cheever to Hubbard, 10 June 1878, ESP Lbk. 1:394–95, UHP.

-1314-

To Uriah Painter

MENLO PARK, N.J.[a] May 2 1878—

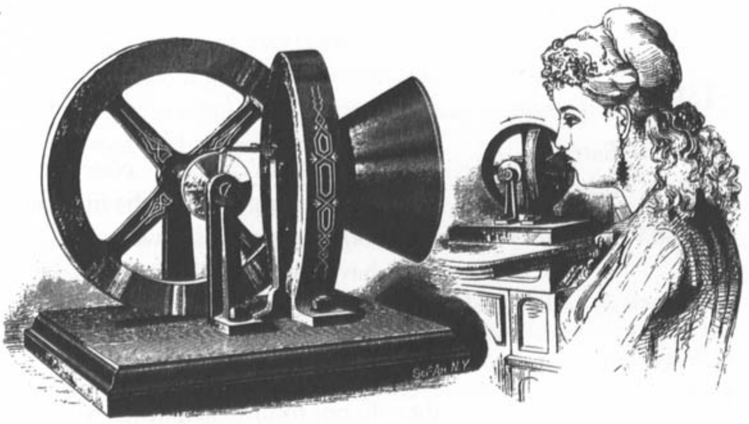
UH.P.

Phonograph must come out before anything—[1] I send model of Phonomotor, (boring machine) to patent ofs in few days[2] It will make one of the best scientific toys of the day.— I also send model of Apparatus for printing phonographic records ie[b] making duplicates.[3] This will earn more money than the phono= rush them through. These violent changes of policy on sale of phono is scarcely the correct thing[4] The phono ought to have ~~an~~ a supreme executive. Yours

Thos. A. Edison

Where is the large photograph

Drawings of Edison's phonomotor from Scientific American.

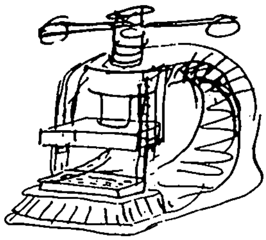


ALS, PHi, UHP. [a]Place from Edison's laboratory handstamp. [b]Circled.

1. In a letter the previous day, Painter had asked Edison about his progress on the phonomotor and aerophone. DF (*TAEM* 15:585).

2. The phonomotor used a pawl attached to a diaphragm to engage the teeth of a ratchet wheel. This linkage converted the diaphragm's vibrations into continuous rotary motion by means of a flywheel. Charles Batchelor made a measured drawing of the device on 1 May (NS-78-008, Lab. [*TAEM* 7:881]) from which John Kruesi constructed an instrument that is probably the one at the Edison Institute (Acc. 00.1382.496, MiDbEI[H]). Edison did not execute a patent application

until 31 August (U.S. Pat. 210,767). A 27 July *Scientific American* (39:51) article noted Edison's claim that "he will have no difficulty in making the machine bore a hole through a board" ("Edison's Phonomoter," Cat. 1030:31, Scraps. [*TAEM* 25:272]).



Edison's drawing of a stamping press for duplicating phonograph records.

3. This may have been a stamping press, a drawing of which appears in a 10 May draft caveat (NS-78-007, Lab. [*TAEM* 7:873]). Though Edison discussed other methods for duplicating phonograph recordings in his 29 May caveat (Doc. 1341) he did not include this press.

4. Edison may be referring to the decision to lease phonographs for exhibition rather than sell them outright. The company had sent a circular letter on 1 May indicating that machines would soon be ready for delivery on payment of $100. However, on 17 May the *New York World* reported that the company had decided on "a more profitable scheme, and refused to deliver the machines," offering instead exclusive short-term exhibition license for the same amount. Gardiner Hubbard had apparently made this change in late April at which time Charles Cheever complained that "the programme which I laid out was the result of a great deal of consideration and consultation between Mr Painter and myself. I return finding the whole thing changed and mixed up." Hubbard, however, had "no doubt that for the next few months we can make more money by exhibiting the phonograph than in any other way." "The Phonograph's Last Device," *New York World*, 17 May 1878, Cat. 1029:68, Scraps. (*TAEM* 25:195); Cheever to Hubbard, 24 Apr. 1878, and Hubbard to Sanders, 1 May 1878, both Box 1205, NjWAT; see also Doc. 1308 n. 5.

-1315-

Notebook Entry: Natural Philosophy and Natural Theology

[Menlo Park,] May 2nd 1878.

Axioms.[1a]

1. Articulate Speech consists of two parts Musical sounds and clang sounds, the first varying in pitch and volume with enormous rapidity, while the latter is composed of vibrations having no definite relation with one another.[2]

2. The diaphragm of a telephone or phonograph is delicate to vibrations which follow each other with some degree of regularity and very insensitive to the same vibrations when they do not follow each other with regularity, hence the vowel sounds powerfully affect the plates and the hissing or clang sounds do not affect it so powerfully.[3] The diaphragm equals the ear in the reception and reproduction of sounds composed of musical vibrations, but is far inferior to the ear in dealing with clang sounds. I infer that the enormous complications of the human ear is more especially designed by the Creator to analyze clang sounds, such as the dropping of water, clapping of hands, etc. etc. sounds which the Phonographic disc seems to be unable to do.[4]

3 That the Universe has always existed and will always

exist are self evident ~~propositions~~ facts and that space is infinite is also self evident, because the mind of man cannot conceive the creation of so much matter for[5] nothing or the destruction of the same nor can he conceive a point on one side of which is space and the other side no space.[6]

4 Each ultimate particle of matter is endowed with intelligence.[7]

5 Those nations whose people live upon a mixed diet are the most civilized. A mixed diet gives a diversity of ideas, ideas coming from the oxydation of food. Instance the greater learning in cities where the diet is more mixed than in the country; and the superiority of the French English and German speaking people, and per contra the Chinese who live mostly on rice who will continue to think in the same channels as long as they are confined to this one cereal[8]

6 The dissipation of energy at the loss which takes place in the transformation of one force into another is lost in other forms of energy unknown to us, hence the existence of unknown forces other than light, heat, electricity etc.[9]

7 All matter is under strain of Gravitation, hence if Planetary changes cause an increase or decrease in the attraction of gravitation, it would account for a deal of force on our earth.[10]

8 Either light exerts an attractive power and lifts organic matter against gravity as for instance the rise of a potato vine in a cellar to a hole in the roof of same, or else a potato vine is endowed with intelligent energy[11]

X, NjWOE, Lab., Cat. 995:1 (*TAEM* 3:275). Written by Charles Batchelor. [a]All underlined portions of this document were underlined twice in the original.

1. These axioms apparently represent Edison's ideas, although they are in Batchelor's hand and are unsigned; Edison elaborated upon the subject of the fifth numbered paragraph during a luncheon interview the same day (see note 8). Most are closely related to topics and currents of thought that were reasonably familiar, though not commonly accepted, among the nineteenth-century educated public, such as readers of *Popular Science Monthly.* These notes, which come at the start of an otherwise empty volume, are unusual for notebooks of this period, but see Doc. 1651.

2. This distinction—essentially between musical tones and noise—was commonly made in contemporary textbooks on acoustics. Referring to noise as "clang sounds," however, was not common. See e.g. Atkinson 1886, 192; Avery 1885, 375; Peck 1866, 168–69.

3. Edison had not fully overcome the difficulty with sibilants and this continued to be a focus of experimentation at the laboratory through the summer. For some indications of this work see Docs. 1164 n. 5, 1190

n. 3, 1203, 1227, 1320, 1341, 1356, and 1400. The distinctiveness of vowel sounds was the subject of considerable research by others, see e.g. Doc. 1311 n. 3.

4. Edison rarely invoked this physico-theological argument from design when he expounded on religion (but see also notes 6 and 7). Religious views attributed to him did appear in a few newspaper stories around this time. In his *Chicago Tribune* biographical sketch (App. 3), George Bliss claimed that Edison "says the existence of a God can be demonstrated in a thousand ways to an absolute certainty, but he has no religious convictions in the ordinary sense." According to a letter to the editor of the *New York Daily Graphic,* Edison had stated in an interview that religion "is a matter I have studied somewhat, but I haven't been able to get any clue to any first cause, or any hereafter" ("Origin of the Phonograph, 16 May 1878, Cat. 1029:62, Scraps [*TAEM* 25:192]). A Boston paper reported that "Edison believes in a God, and one that is all-powerful alike to create and to destroy. He is not a regular attendant of church. He claims kinship with no particular denomination or school of philosophy, but approaches nearer to the Deism of the younger [John Stuart] Mill than anything else. But modification would probably have to be made in this to suit his views and beliefs. He is a devout man and full of goodness" ("The Phonograph, Etc.," *Boston Daily Evening Traveller,* 23 May 1878, Cat. 1240, item 620, Batchelor [*TAEM* 94:211]).

5. Probably should have been "from."

6. This agrees with conclusions Thomas Paine set forth in his deist natural theology, *The Age of Reason,* and with the argument Paine gave regarding the infinity of space. Paine was one of the few philosophers whose works Edison ever directly stated he had read and he clearly was impressed greatly by them (Edison 1925; Edison 1948, 151–58). Paine's own argument for the eternity of the universe, however, also relied on the inconceivability of a terminal point or moment, as in the case of space, rather than on any problem with the concept of *ex nihilo* creation, as given here (Paine 1967, 47). Another philosopher commended by Edison, Herbert Spencer, did insist that both creation and destruction of matter are strictly inconceivable (Spencer 1898, 180–82). For Edison's view of Spencer see Shaw 1878 (p. 490), in which Edison is reported as asserting that there is "no philosopher like Herbert Spencer, no writer like Victor Hugo, and no poet like Edgar A. Poe."

7. Edison later made this claim in newspaper and magazine interviews (see, for example, Edison 1948, 205–44). Although Ernst Haeckel's stream of popular writings, amplifying Goethe's maxim "no mind without matter, no matter without mind," had begun circulating in the preceding few years, such outright assertions of panpsychism were not common (but cf. note 11). Rejections of the orthodox concept of ultimate matter as inherently inert or "dead," however, were as frequent in philosophical and popular writings of the era as they had been in the century before. Both Paine and Spencer concluded that matter is essentially active. "Intelligence" also could be used merely to refer to any rudimentary suggestion of apparently purposive action. Edwards 1967, s.vv. "Haeckel, Ernst," "Panpsychism"; Toulmin and Goodfield 1977, 307–36.

8. Edison was quoted extensively on this topic in the *Cincinnati Commercial.* Describing his lunch with Edison at a New York restaurant on 2 May, the *Commercial's* reporter quoted Edison as saying "I have a the-

ory of eating. Variety—that is the secret of wise eating. The Nations that eat the most kinds of food are the greatest Nations." As lunch proceeded, Edison elaborated:

> The rice-eating Nations never progress; they never think or act anything but rice, rice, rice, forever. Look at the potato and black-bread eaters of Ireland; though naturally bright, the Irish in Ireland are enervated by the uniformity of their food. Look at the semi-savages who inhabit the Black Forest. On the other hand, what is, take it all in all, the most highly enlightened Nation, the most thrifty, graceful, cultured and accomplished? Why, France, of course, where the cuisine has infinite variety. ["New York Letter," 5 May 1878, Cat. 1029:47, Scraps. (*TAEM* 25:183)]

While popular and academic theories of environmental influences and national character were widespread at the time, Edison's emphasis on variety of diet may be unique. However, the general notion of a relation between food and thought had been aggressively proclaimed by various materialist philosophers and doctors in the middle of the century, particularly by Jacob Moleschott, whose works contain a general view of thought as a product of physiological chemistry, an emphasis on the key role of oxidation, and the claim that the Irish were oppressed in part through their reliance upon a diet of potatoes (cf. Gregory 1977, 87–92). For the context of common attitudes about supposed national, ethnic, or racial characters, and the physical theories to account for them, see Gossett 1963, Higham 1970, Duijker and Frijda 1960, and Haller 1971.

9. Along with the principle of conservation of energy, the idea that "dissipation of energy" was a general pattern of fundamental importance had been developed in mathematical physics since the middle of the century and had been given various popular formulations. In the same period, Herbert Spencer set forth his general philosophy to widespread acclaim, including Edison's. Spencer emphasized processes of dissipation and conservation, although he wrote in terms of force and motion rather than energy. While quite different from each other, these two concepts of dissipation each dealt with relationships among known forms of energy or force as they are transformed from one to another; the losses in question were energy lost to use or momentum lost to view, but all clearly accountable. In contrast to both of these well-known views, Edison here assumed that not all the energy going into some transformations was accounted for among the identified outcomes, so some energy seemed to be really lost, but he also took conservation of energy for granted; this is closely related to his understanding of his experiments with what he called "etheric force" (see e.g. Doc. 678). For ideas about the dissipation of energy see Brush 1978.

10. The actual strength of such gravitational force is insensibly tiny for phenomena on any scale much smaller than that of the motion of the earth as a whole. See, for example, Culver and Ianna 1979, 104–7.

11. The subject of motion in plants was becoming a major area of research involving eminent scientists, such as Charles Darwin and Julius Sachs, and also was being drawn into philosophical debates over the nature of life and evolution by writers such as Samuel Butler. Pauly 1987, 35; see, e.g., Darwin 1875 and Butler 1877.

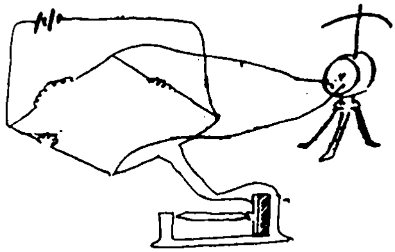
-1316-

Notebook Entry: Tasimeter

[Menlo Park,] May 2nd 1878

Pressed Carbon Micro-Tasimeter[1]

We have long noticed the expansion and contraction of our telephone cases and consequent~~ly~~ variability of adjustment and about the middle of April[2] made an instrument to detect fine degrees of heat which consisted of a button of our pressed carbon suitably mounted with a s~~heet~~trip of rubber resting against it on which the heat strikes lengthening or shortening same and putting more or less pressure on When arranged with battery and galvanometer in Wheatstone bridge it is exceedingly sensitive.[3]



If a strip of gelatin be substituted for the hard rubber it is exceedingly sensitive to moisture also.

Chas Batchelor

X, NjWOE, Batchelor, Cat. 1317:57 (*TAEM* 90:685). Written by Batchelor.

[1] Batchelor may have added "Micro-Tasimeter" at a later date. The term seems not to have replaced "Carbon Electro-Thermometer" until mid-June. See Docs. 1289 n. 3 and 1329 n. 1.

[2] See Doc. 1289 n. 3.

[3] This design was first published in the 22 June issue of *Scientific American* ("Edison's Micro-Tasimeter" [38:385]). That article described how Edison's work on a heat measurer had been stimulated by Samuel Langley (see Doc. 1367). In a 7 June letter, Langley asked Edison for one of his tasimeters, and on 10 June astronomer Charles Young of Princeton described experiments he and Cyrus Brackett, a Princeton physicist, had carried out with an instrument that was apparently based on the *Scientific American* description. Young asked Edison for some of his carbon buttons to aid their work and also invited him to "come & see us & what we are doing by way of preparation for the eclipse." The *Scientific American* article, which was widely reprinted, stimulated other responses, as did other, less detailed newspaper accounts. For example, Dr. J. F. Tucker, a prominent Chicago physician, wrote about the possible use of the tasimeter to determine body temperature, and John Long, an American at the University of Tübingen in Württemberg, was interested in using it for his experiments on the conductivity of heat in fluids. Long also reported interest in the tasimeter among professsors at the university and told Edison he "should be much pleased to introduce your instrument among the German chemists." "Edison's Micro-

Tasimeter," *Sci. Am.*, 22 June 1878, Cat. 1240, item 681, Batchelor (*TAEM* 94:233); Langley to TAE, 7 June 1878; Young to TAE, 10 June 1878; Tucker to TAE, 15 June 1878; Bliss to TAE, 18 and 27 June 1878; Long to TAE, 11 July 1878; all DF (*TAEM* 15:760, 19:415–19, 422–23).

-1317-

To Theodore Puskas

Menlo Park May 3= 78

In Haste,
Friend Puskas

Expect to send Two[a] clockwork phono for Exposition on the tenth, via London, Austin Baldwin Express look out for them= I understand that the Patent would be void is more than one machine was imported, but I, suppose you can fix that. We have great improvements, last night I recorded a sentence 16 feet from the instrument, & reproduced it audibly= The voice of everyone now comes out loud so that there[b] is not that great diference between my speaking & a stranger as in the machines you have =The great improvement consists in having no shake or lost motion in the shaft bearings, otherwise the talking is poor= Johnson is clearing 100 dollars per night exhibiting machine in 23rd st has been running 16 night & crowds are getting larger. The Standard machine is coming in fast. I signed today another Very elaborate phonograph patent with 60 drawings[1] This I have ordered Serrell to take out in all the Countries It[b] will secure the thing tight= I find its impossible to get patents in South America the cost is too gr~~a~~eat to obtain concessions so I have told a lot of people here to go ahead & do what they pleased about it giving me something which I will see that you get your share=[2] I sent your English Contract several days ago=[3] I do not know if you will like the provision about lawsuits but you must consider that I must for many years perform labor & expend money, hence I considered that it would be only fair that you should pay any law suits which may never arise= I think the new patent will fix it all right I applied for provisional protection twenty days ago=[4] You do not send me any Paris papers, do you get those I send you The Contract on telephones with WU Tel is closed[5] I get $6000, yearly for 17 years and $500 yearly on improvements which[b] is to be paid for 17 years. This will probably bring me in $12 000 yearly for 25 years=

I am going to ship in a few days in addition to the ~~han~~ clockwork Exhibition inst a hand machine that will work perfectly & continue so for months without touching it It will be very solid but cheaply made= All my telephones on WU wires continue to work better than I ever expected= We have greatly simplified them since we shipped the Exposition telephones= Adams tells me the Sea air has spoilt his carbons=[6] I do not understand this= I have shipped some more telephones & carbons in a tin case soldered to exclude the air=

Please see your parties in England & have them write what particular things is necessary to disclaim=[7] Counsel here upon my explanations say they do not see that I should disclaim anything but they may be wrong=

AL, HuBPo, TP. [a]Interlined above. [b]Obscured overwritten letters.

1. See Doc. 1341 n. 1.

2. On 8 May, Edison arranged with T. J. Smith to exhibit the phonograph and carbon telephone along the west coast of Central and South America. Smith was associated in this enterprise with L. A. Ludwig of the Commercial News Department of the Gold and Stock Telegraph Co. By the end of June, Smith had established a telephone line across the Isthmus of Panama in connection with the Pacific Mail Steamship and Pacific Railroad Companies. Agreements between Smith and TAE, 8 May 1878, Miller (*TAEM* 28:1090, 1101); Smith to TAE, 11 Mar., 18 and 20 Apr. 1878; Ludwig to TAE, 28 June 1878, all DF (*TAEM* 15:342, 537, 543; 19:865).

A month later, Edison appointed Frederick W. Jones as his agent to obtain phonograph patents in Brazil and Argentina. He also gave Jones the sole right to manufacture, use, and sell the phonograph in those countries. After arriving in Brazil, however, Jones found someone already there exhibiting a phonograph which he had apparently purchased in Paris from Puskas. While Jones was waiting for his phonograph to arrive from New York this party gave free exhibitions, including one to Dom Pedro, the Brazilian emperor to whom Edison had hoped to send one of his clockwork phonographs when they were completed. As a result of these free exhibitions Jones was unable to draw sufficient spectators for his own. He did, however, obtain phonograph patents for Edison in Brazil and Argentina by the beginning of October. Memorandum of agreement and power of attorney between Jones and TAE, n.d. and 4 June 1878, Miller (*TAEM* 28:1092, 1125); Jones to TAE, 1 June, 23 July, 5 Oct., and 6 Dec. 1878; J. C. Rodriquez to TAE, 20 May 1878, all DF (*TAEM* 15:735; 19:239, 283, 317, 328); TAE to Rodriquez, 26 May 1878, UHP.

3. That is, the agreement between Edison and Puskas of 16 April 1878 (TP).

4. It is unclear exactly when Edison signed the British provisional patent specification (Brit. Pat. 1,644 [1878]). He had not done so by 10 April, when Serrell asked to see him about it in New York. If Edison's statement of twenty days is correct, he would have signed it on 12 April. Serrell to TAE, 10 Apr. 1878, DF (*TAEM* 18:653).

5. This agreement was not executed until 31 May, but Edison and new Western Union president Norvin Green signed a memorandum of agreement on 29 April. Miller (*TAEM* 28:1105); WU Coll.

6. See also Doc. 1248.

7. See Doc. 1237.

-1318-

To William Preece

MENLO PARK, N.J.[a] May 4= 78

Friend Preece:

The air of the sea must be vastly different from that over a tub filled with salt water, because[b] carbons placed over the tub[b] are not affected. I have sent my latest from of Telephone—non expansion & non-adjustable with supply of carbons in a sealed tin case by Col Gouraud.[1] Tell Adams to write details. ~~H~~Do they work well on a Rheostatic line.[2] WU closed contract[c] after all the tests and Mr Phelps is making a quantity. They pay $6000. yearly for 17 years and $500 yearly for 17 yrs for each valuable improvement.

My Solicitor & myself are at sea about the disclaimer business. We cannot comprehend what is to be disclaimed, as The phonograph is[b] used as a Telephonic recorder and is just as much a part of a Telephone as a Morse inker is a part of the Morse system. You may listen to a Morse sounder & receive the message phonetically and the same with a Telephone or you may substitute the Morse sounder for a register or ink recorder or the Telephone with a phonograph. My Telephone patent was the next to Bells in point of time in England. Would you be so kind as to have the claims written out & your idea of those to be disclaimed =I have applied for another very important patent in England covering the phonograph fully, final specfs go next week= I have been backward in asking you to spend your time looking after my interest because I could not see where you was to receive any consideration thereform. If you will point out where I can reciprocate financially (outside of Telegraph matters which of course you could have no interest) I will brush up sufficient "cheek" to ask you to assist me. Have you a private laboratory, if not you ought to have one. Why not make Jack the public pay for one when we do so much for him= I hope Mr. Nottage & Puskas wont quarrell, both seem to be square men. Ive got two new things besides Aerophone that I want you to wet nurse over there before the public=[3] At present my time is entirely taken up by the phono= See Alex J Ellis in Nature.[4] Ill make him take a back seat in the cellar within 90 days. how foolish in him to make a statement like he did from results attained by a ~~mach~~ mere experimental machine;= I spoke 16 feet from the phono last night & it reproduced it. The articulation is perfect but the tone is not as yet quite natural= More anon from your Friend

Thomas A Edison

ALS, UkLIEE, WHP. [a]Place from Edison's laboratory handstamp. [b]Obscured overwritten letters. [c]Interlined above.

1. Gouraud sailed for England on 24 April. Gouraud to George Prescott, 23 Apr. 1878, DF (*TAEM* 19:506).

2. Probably an underground cable (see Docs. 1319 and 1331).

3. The two new things were probably the phonomotor and tasimeter, though Edison may also have been referring to his harmonic engine, the sewing machine motor he and Batchelor had been working on since October 1876 and which was now being mentioned in the press. See Docs. 800, 802, 829, and 1129; and "Thomas A. Edison," *Chicago Tribune,* 4 May 1878, Cat. 1240, item 578, Batchelor (*TAEM* 94:193).

4. Alexander Ellis was an English philologist and mathematician (*DNB,* s.v. "Ellis, Alexander John). At Alexander Graham Bell's invitation, he experimented with a phonograph made by Augustus Stroh, which differed "in many respects from the one described by Prof. Mayer." In a 13 April letter to *Nature* (17:485–86), Ellis reported:

> The difference between words produced from the phonograph and those spoken into it gave me the same feeling as the difference between a worn print and an early proof of an engraving. When the words were uttered loudly and slowly and repeated rather faster, it was easy to catch the sense and meaning, but I doubt whether unknown English words would be recognised, and certainly unknown foreign words would present insuperable difficulties. [Cat. 1029:28, Scraps. (*TAEM* 25:176)]

He concluded that the phonograph had not yet "risen beyond a lecture illustration or a philosophical toy." However, on 30 April he wrote another letter to *Nature* (18:38) acknowledging that "the phonograph has already risen beyond the rank of lecture illustrations and philosophical toys, to which I assigned it in my last, and . . . promises to lay some permanent foundations" for acoustical science (Cat. 1030:25, Scraps. [*TAEM* 25:268]).

-1319-

From Lemuel Serrell

New York, May 6th 1878.[a]

Dear Sir:

I send below a copy of a communication from my London correspondent. Yours truly

Lemuel W. Serrell pr Pinckney

"We regret very much to be obliged to report the failure of Telephone (Edisons) up to the present. we had a conversation with Mr. Preese on the subject this week and he appears to have written very fully to Mr. Edison.[1] We have not seen Mr Adams yet but we understand that he is working very hard to try to put matters right, and is very annoyed naturally. The difficulty is with the underground wires and a telephone is useless here unless it will work when some of the wires are underground. Mr. Preese is very much disappointed. Of course Messrs Vallance cannot proceed until the Telephone works well and let us hope this will be done before something else better gets into the market"

L, NjWOE, DF (*TAEM* 19:851). Letterhead of Lemuel Serrell. [a]"New York," and "187" preprinted.

1. Not found.

-1320-

Technical Note: Phonograph

[Menlo Park,] May 7th 1878[a]

Note.

In Phonograph when you speak, the loud tones like vowel sounds go deeper in I should think and consequently are deeper in proportion to their length, & the spring may not go to the bottom of sthese so readily as shallower[1] so if you had a cast or electrotype of wrong side and worked with strong spring the tones that were deepest[b] would make most noise: But still the vowel sounds are now the strongest vibrations and we get the strongest sound from them & are trying to weaken them[b] or reinforce the weaker ones

C Batchelor

X, NjWOE, Lab., Vol. 17:88 (*TAEM* 4:957). Written by Charles Batchelor. [a]Followed by double horizontal line. [b]Obscured overwritten letter.

1. In February, Edison had debated with William Hollingshead whether the reproducing point reached the bottom of deep indentations in a hard material. According to Hollingshead, Edison thought it had to do so in order to reproduce loud sounds. Hollingshead disagreed, arguing that this would actually create distortions. To settle the issue, he suggested that Edison coat a recorded cylinder with a thin carbon film and then play it on the phonograph. The reproducing point would scrape off the carbon, either revealing "a clean, clear line" if the point reached the bottom of each indentation, or leaving traces of carbon if it did not. Edison does not appear to have performed this experiment. Hollingshead's testimony, pp. 45–46, *American Graphophone v. Leeds & Catlin.*

-1321-

From Charles Harris

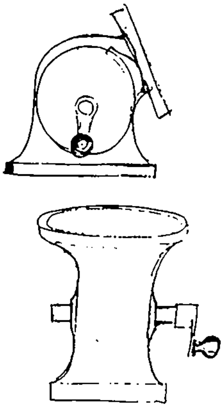
New York May 8th 1878

Dr Sir.

Acting on your suggestion, I have engaged John Ott[1] to report to you, to work under your instructions for the purpose of getting a toy box, such as we talked of yesterday.[2] I have given him money to purchase supplies for immediate use. I feel more confidence in the success of this step, than any[a] that has yet been taken towards producing toys, and that it will result to our mutual benefit.

Hollingshead will continue his electrotype experiments. Have cabled Puskas.[3] Yours Truly

C B Harris[4]



Charles Batchelor's drawings of a speaking toy.

ALS, NjWOE, DF (*TAEM* 19:66). [a]Obscured overwritten letters.

1. John Ott had worked as a machinist in Edison's Newark shops from 1870 to 1875. This is the first reference to him since he had made electric pens for Edison in 1875 and it is unknown if he had been working with Edison at Menlo Park. See Doc. 623.

2. The following day Charles Batchelor made several drawings for a talking toy. Vol. 17:91–93, Lab. (*TAEM* 4:960–62).

3. Not found.

4. Charles Harris had joined Oliver Russell in the phonograph toy contract sometime after 22 April. He had a business in New York making or selling bells. Russell to TAE, 22 Apr. 1878, DF (*TAEM* 19:59); Wilson 1878, 588.

-1322-

From Stockton Griffin

[New York,] May 9, 1878

Friend Tom

I am afraid I cant join you before June 1st unless you are going to be seriously inconvenienced by my not coming. Eight days is pretty short notice to give where one has worked so long as I have. I would be pleased[a] to hear from you and will abide by whatever you say.

My[a] retirement from the ofs is making a commotion. Yrs

Griff[1]

ALS, NjWOE, DF (*TAEM* 15:632). [a]Obscured overwritten letter.

1. Stockton Griffin, who had worked with Edison in Cincinnati in 1867, had been in charge of the Eastern wires in Western Union's main New York office for several years. Previous to that he had worked for the Gold and Stock Telegraph Co. He resigned his position at Western Union to become Edison's personal secretary. See *TAEB* 1:297 n. 1; *Operator,* 1 June 1878, 10.

-1323-

To the Editor of the New York Daily Graphic

MENLO PARK, N.J.[a] May 10 1878.

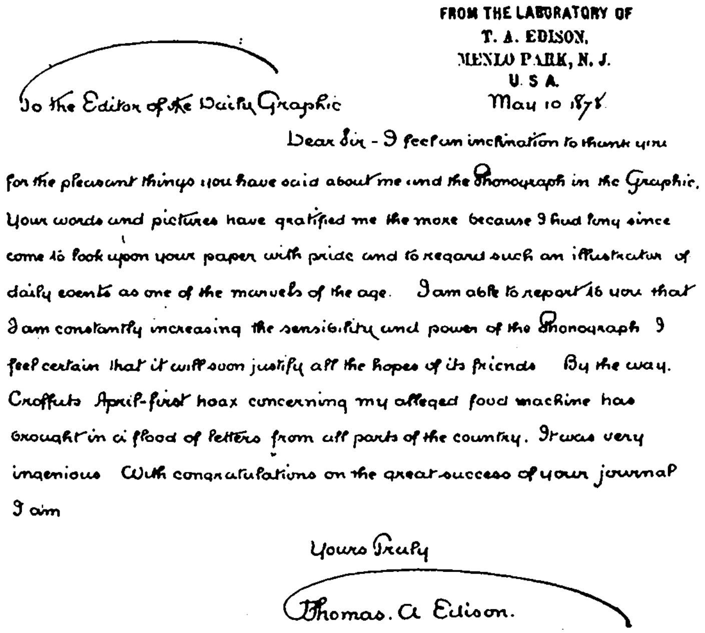
Dear Sir[1]—

I feel an inclination to thank you for the pleasant things you have said about me and the Phonograph in the Graphic. Your words and pictures have gratified me the more because I had long since come to look upon your paper with pride and to regard such an illustrator of daily events as one of the marvels of the age. I am able to report to you that I am constantly increasing the sensibility and power of the Phonograph. I feel certain that it will soon justify all the hopes of its friends By the way, Croffuts April-first hoax concerning my alleged food machine[2] has brought in a flood of letters from all parts of the country.[3] It was very ingenious. With congratulations on the great success of your journal I am Yours Truly

Thomas. A Edison.

ALS (photographic transcript), NjWOE, Batchelor, Cat. 1240:597 (*TAEM* 94:197). [a]Place from Edison's laboratory handstamp.

This facsimile of Edison's letter was published in the 16 May New York Daily Graphic.



FROM THE LABORATORY OF
T. A. EDISON,
MENLO PARK, N. J.
U. S. A.

To the Editor of the Daily Graphic

May 10 1878

Dear Sir - I feel an inclination to thank you
for the pleasant things you have said about me and the Phonograph in the Graphic.
Your words and pictures have gratified me the more because I had long since
come to look upon your paper with pride and to regard such an illustrator of
daily events as one of the marvels of the age. I am able to report to you that
I am constantly increasing the sensibility and power of the Phonograph I
feel certain that it will soon justify all the hopes of its friends By the way.
Croffuts April-first hoax concerning my alleged food machine has
brought in a flood of letters from all parts of the country. It was very
ingenious With congratulations on the great success of your journal
I am

Yours Truly

Thomas. A Edison.

1. The text of this letter was taken from a draft written by William Croffut at Edison's suggestion (Croffut to TAE, 10 May, with draft, DF [*TAEM* 17:91]). The version in Edison's hand was published in the *Graphic* of 16 May (p. 544) with the caption "Fac-simile of a letter from

the inventor of the telephone and phonograph." The *Graphic's* editor commented on Edison's handwriting.

> This peculiar penmanship is no affectation, nor is it adopted for an occasion; but it is the uniform style of all the inventor's personal letters. It does not look like the hand of an intensely busy and hurried man, but he explains to his friends that while his hand was still unformed, he chose this, because it was legible and because he found by practice that he could write it as fast as any other. He dashes off his letters with the rapidity of an accomplished clerk, but every one of them is a work of art. [p. 538, Cat. 1029:62, Scraps. (*TAEM* 25:192)]

Edison developed the signature shown here in early March. By April he settled on this as the standard form of his public signature. It eventually became a trademark.

2. See Doc. 1282.

3. These letters have not been found; however, the 6 April issue of the *Graphic* contained a few responses in an article titled "They Bite." Cat. 1240, item 497, Batchelor (*TAEM* 94:157).

-1324-

From James Heenan

New York, May 10, 1878[a]

Mr. Edison:

Please do not forget your engagement for Decoration Day, Thursday, May 30, at Mt. St. Vincent,[1] thirteen miles up the Hudson by railroad from the depot W. 30th St. bet 9th and 10th Avs. You are expected ~~are expected~~ to bring your wife and children and any friends you wish to invite. You and your assistants with company[2] are desired[b] in the morning and for dinner, to prepare for the exhibition of your inventions, inspect the magnificent academy, stroll through the grounds, see Edwin Forest's famous castle and the museum,[3] and visit the house of Mr. Morosini[4] (Mr. Jay Gould's Secretary) about fifty yards from the Mount gate. Mr. M. has a rare collection of curiosities which he wishes you to look at. He has a beautiful place and will entertain you nicely. At the Mount there may be some grand music if time permits.

At the exhibition of your inventions there will be present representatives of the New York and National Associated Presses, the City and Metropolitan Presses, the New York newspapers and special correspondents of Baltimore, Boston, Philadelphia, Washington, Cincinnati, Chicago, St. Louis, New Orleans, San Francisco, Canadian and other papers. You might invite Mr. Amos Cummings, of the Sun, to accompany you in the morning. The other journalists will not leave until 1 p.m. The 30th being such a holiday its feature in the news line outside of the regular Decoration doings may be your "layout"

If not asking too much try[b] to have an exhibition of your speaking and musical telephones and electric pen as well as the phonograph—[5]the more, you know, the better under the circumstances. It would be well to have a fair description of each instrument or machine for all the reporters to copy from. If I had the descriptions in time I could have thirty copies of each made on manifold or with the electric pen in order to save work for the newspaper men.

All expenses, fare, expressage, help, &c. will be paid by me. I will accompany your party to the Mount and remain with it until the return to the city.

I see Mr. Griffin, our old western friend, every day now. I understand he will be with you after the 15th. I have been explaining things to him. He and his company will be with us.

Several days ago, April 29, the Sun had a splendid article[6] on your inventions and I hurriedly made the enclosed dispatch from it Want of time and telegraphic facilities[b] prevented something much better, although I had already pretty well covered up the subject in previous dispatches. The wires on April 29 could not accommodate the matter on hand in the morning.

Two[c] or three trains leave for the Mount on the morning of the 30th, including one from the Grand Central Depot. Your party is expected on the 11 a.m. train from 30th St. if it can not start earlier. All other persons take the one o'clock train. It takes 40 minutes to get to the Mount from 30th St., and a little less from 42d St. I will write again and send time table.[7]
Yours truly,

James R. Heenan[8]

ALS, NjWOE, DF (*TAEM* 15:639). Letterhead of National Associated Press. [a]"New York," and "187" preprinted. [b]Interlined above. [c]Obscured overwritten letters.

1. The Convent (now College) of Mount St. Vincent was a Catholic girls' school. It stands on the east side of the Hudson River at what today is the northernmost point of New York City but at that time was neither urbanized nor within the city limits. An unknown number of invited guests attended Edison's exhibition. "The Magician of Science," *New York Sun,* 31 May 1878, Cat. 1240, item 632, Batchelor (*TAEM* 94:216).

2. It is unknown if Edison's family attended. According to press reports he was accompanied by Charles Batchelor, Martin Force, George Carman, Stockton Griffin, and Frank McLaughlin. Ibid.

3. Edwin Forrest, an actor famous for his tragic characters and off-

stage scandals, built a Norman-style castle that he never occupied. The Mount St. Vincent convent acquired the building after his death in 1872 and filled the library with a mineral collection. Ibid.; *DAB,* s.v. "Forrest, Edwin."

4. Giovanni Morosini, a former sailor, became Gould's bodyguard and personal secretary in 1872. Klein 1986, 86.

5. According to news accounts, Edison demonstrated the phonograph and had guests try the speaking and musical telephones. The electric pen was also on display. A vocal performance by a student concluded the exhibition. "Mr. Edison in a Convent," *New York World;* "Phonograph and Telephone," *New York Herald;* and "The Magician of Science," *New York Sun;* all 31 May 1878, Cat. 1240, items 628–29, 632, Batchelor (*TAEM* 94:215–16).

6. "The Inventor of the Age," *New York Sun,* 29 Apr. 1878, Cat. 1240, item 561, Batchelor (*TAEM* 94:106). Heenan's enclosure has not been found.

7. On 28 May, Heenan wrote Edison with train information and expressed his hope that "Mrs. Edison will be well enough to go to Mt. St. Vincent Thursday morning." DF (*TAEM* 15:709).

8. An acquaintance from Edison's days in Louisville, Heenan was an official of the National Associated Press in New York. "The Magician of Science," *New York Sun,* 31 May 1878, Cat. 1240, item 632, Batchelor (*TAEM* 94:216).

-1325-

From Mrs. Andrew Coburn

Brooklyn May 13th 1878

Dear Sir

Knowing your pecularities for no long letters, and a dislike to long conversations, I will make my letter short as possible. I intended to go and see you, but thought best to write at the present. My Husband has been disabled for over three years with a fractured elbow & now about to have it amputated has been confined to the bed for over two weeks with a Lung[a] difficulty which makes it much worse & I thought would solicit alms from you—temporary, even but little, it would be a great help. My Husband Andrew D Coburn[1] you will remember was in your employ nearly two years, as Inspector & Tool Keeper on Rail-Road Av. Newark, N.J. My health you will remember never was very good, & in trying to work & keeping my family together I am entirely broken down. My Husband would be only too glad to see you—if you could spare time to come—

If you can & will assist me, it will be much appreciated—[2]

I remain   Yours with Respect

Mrs A D. Coburn.

"We are in perfectly destitute circumstances."

ALS, NjWOE, DF (*TAEM* 15:650). [a]"n" interlined above.

1. Andrew Coburn first worked for Edison as a machinist at the American Telegraph Works in November 1870 and moved to Edison and Unger in 1871. Cat. 30,108; Cat. 1210:96, both Accts. (*TAEM* 20:189, 664).

2. Stockton Griffin wrote on this letter "Ansd & sent check for $5." Mrs. Coburn thanked Edison on 23 June and wrote again on 13 July asking for a $50 loan to start a business making socks, garters and leggings. In July, Andrew Coburn asked Charles Batchelor to intercede on his behalf and in September the surgeon treating Andrew Coburn also appealed for Edison's assistance. It is not known if he provided any additional money. Mrs. Coburn to TAE, 23 June, 13 July, and 31 Oct. 1878; George Fowler to TAE, 1 Sept. 1878; Andrew Coburn to Batchelor, 25 July 1878; all DF (*TAEM* 15:826, 933, 996; 16:2, 356).

-1326-

From Uriah Painter

W-DC— 5-13-78

My Dr E,

Yours of 5–12 to hand—[1]

Hurrah for the Telephon[o]s[co]pe[2] I'll get the patent on it for you promptly as the others.

If it will work & I believe it will, if you say so there money in it, a heap! If its big now, it will be reduced![3] I thought you had some Phono's[4] of EHJ— I told you to take what you wanted! I mail with this 18— I sent 13 large Photo's to NY get 2 of those if you have not one for Batch—

We have the show biz started in good shape— The best man in the Country to manage it—[5] We will have 100 machines sold inside of 104 days @ $100. each & 60 to 80 shows running on the shares—!!

How comes on the Phono?

If you dont let up on JCR.[6] on that matter[a] I'll give you half what we get out of it!

Poor Henry[7] died to-day! He has been too ill to see anyone for some time. I wanted to have got a letter from him on the Phono & you!

Get up Patent application[a] for ~~P~~Telephonoscope right away.

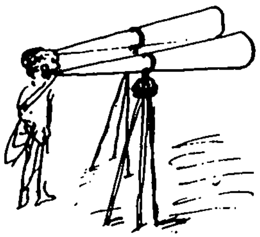
Phonomotor not come yet! ans if Photos come OK—

UHP

ALS, NjWOE, DF (*TAEM* 15:653). [a]Interlined above.

1. Not found.

2. The telephonoscope was a device for receiving sound over great distances. Its basic design consisted of long paper funnels to the ends



Edison's telephonoscope for receiving sound over great distances.

of which were connected flexible tubes for insertion into the listener's ears. When used with a speaking tube, the device reportedly enabled conversation to be "carried on through a distance of one and a half to two miles in an ordinary tone of voice. A low whisper, uttered without using the speaking trumpet, is distinctly audible at a distance of a thousand feet, and walking through grass and weeds may be heard at a much greater distance" (Prescott 1879, 563). Edison made a preliminary notebook drawing of this device on 2 April and on 10 May made sketches for a draft caveat. The instrument subsequently became known as the megaphone. "Edison's 'Ear Telescope,'" *New York Sun;* "The Megaphone," *New York Herald;* both 8 June 1878, Cat. 1240, items 660–61, Batchelor (*TAEM* 94:227); "Edison's Megaphone," *Sci. Am.* 39 (1878): 113–14.

3. Edison explored ways of adapting the telephonoscope for use as a personal hearing aid, a device he termed the auriphone (although for a while he called both instruments the megaphone). He sketched ways in which the listening tubes could collapse telescopically to make them portable, and considered various shapes and arrangements of resonator tubes. Doc. 1361; NS-78-002, Lab. (*TAEM* 7:762); "Ears for the Deaf," *New York Daily Graphic,* 5 June 1878; "The Megaphone," *New York Herald,* 8 June 1878, Cat. 1240, items 645, 661, Batchelor (*TAEM* 94:221, 227).

4. Painter meant "photo's."

5. In a letter of 6 May, Charles Cheever told Gardiner Hubbard that they had hired James Redpath (1833–91) to manage the Edison Speaking Phonograph Co.'s exhibition business. Redpath was to receive twenty percent of the receipts (UHP). Redpath was a former journalist who had become well-known for his abolitionist articles. He had established the Redpath Lyceum Bureau in Boston in 1868 (*DAB,* s.v. "Redpath, James").

6. Josiah Reiff; Edison apparently held promissory notes from him. Painter to TAE, (6 May 1878, DF [*TAEM* 15:612]).

7. Joseph Henry.

-1327-

From William MacMahon

Boston, Mass May 14, 1878

Sir:

I sometime ago arranged with your Company to exhibit the Speaking Phonograph in Boston and to give you an idea of the success we have met with here, I have turned in royalties amounting to $500 at the present time. we opened the exhibition of the Phonograph here on Thursday last. as soon as it was advertised here I received communications from an innumerable number of scientific societies to give them private exhibition and scientific explanations of your great production, prominent among which were letters from the faculty of Harvard College, the American Academy of Arts and Sciences and several other prominent bodies— I made engagements with the above named parties and intended to give them private exhibitions prior to opening here. your company could not however furnish me with a machine in time, so that I was obliged to disappoint them— there is now a great desire here, not only among that element, but also among the representatives of the Boston press, to come personally in contact with you— After due consultation they realize that all your time is valuably occupied. they propose, if agreeable to you, to visit you in body, that is to say the press and representatives of leading Scientific associations, numbering in all not to exceed twenty. their purpose will be to visit Menlo Park, come personally in contact with you, spend a few hours in your company and return to the "Hub"[1]

Will the same be agreeable to you? if so you will confer a favor by designating the day you will be at leasure and when you would be pleased to meet this deputation—[2]

Please answer at once by telegraph, so that I can wait upon these gentlemen and report your decision—

I am very respectfully Your obt Servant

Wm MacMahon[3] Manager of Phonograph Exhibition

P.S. Arrangements have been made for a special car if your decision is satisfactory, and we sincerely hope it will be.

ALS, NjWOE, DF (*TAEM* 15:662).

1. On 22 May, Edward Johnson met MacMahon's group, consisting of representatives from seven Boston newspapers and an unknown number of other visitors, in New York and escorted them to Menlo Park. Edison demonstrated the phonograph, phonomotor, telephonoscope, tasimeter, harmonic engine, and his musical and speaking telephones. The party spent about six hours in Menlo Park. "The Phonograph, Etc," *Boston Daily Evening Traveller,* 23 May 1878; "Edison and His Inventions," *Boston Journal,* 25 May 1878, Cat. 1240, items 620, 622, Batchelor (*TAEM* 94:211–12).

2. In an undated telegram Edison wired MacMahon: "Party can come any time next week." DF (*TAEM* 15:724).

3. William MacMahon managed the phonograph exhibition at Boston's Horticultural Hall (see Whitehill 1968, 185). Nothing further is known of him.

-1328-

From Norman Miller

Tuesday P.M. May 14/'78

Friend Edison,

I enclose the Field-Andrews Contract.[1]

I made copy as you requested, and it is with Mr Lowrey—as you said that I might show it to him—[2] He will be at home tomorrow so if you wish to tell him the rest of the story you can do so at some early day.

The great points just now seems to determine how to find money for finishing Kennys Instruments,[3] with your or Riffs[4] applications and to whom the invention will belong when done— You know what I am driving at is to have it yours and Kennys, that you may sell it to W.U. if they want it, and will pay what it is worth—

I send this by Frank Mac'[5] as better than the mail—

I dont see how you can hope to find a better man than him on Phono for Australia—[6] Hope you will make a trade and both do well. Yours

Miller

ALS, NjWOE, DF (*TAEM* 19:514).

1. Doc. 92.

2. In a letter of the previous day, Miller had remarked that Lowrey could help Edison in regard to facsimile telegraphy "not only with [Elisha] A[ndrews], but also at W.U. when the time comes. . . . If I did not know that he is a good true man to you, I should not ask you to have a talk with him before making any new deal with A." DF (*TAEM* 19:512).

3. Patrick Kenny had been superintendent of Gold and Stock Telegraph Co.'s manufacturing shops in the early 1870s. He was also an inventor and was apparently working at this time on a facsimile telegraph. Edison was considering combining their efforts and approached Andrews about this on 23 May. See *TAEB* 1:372, 621 n. 21; and Andrews to TAE, 24 May 1878, DF (*TAEM* 19:519).

4. Miller apparently meant Josiah Reiff.

5. Frank McLaughlin was a telegrapher acquaintance of Edison's who had been an agent for the electric pen. See Doc. 660.

6. McLaughlin and Charles Harris had acquired rights to Edison's phonograph for Australasia. McLaughlin was to go to Australia to exhibit the phonograph, with Harris paying his expenses, including the purchase of two phonographs from Edison. The three men were to equally divide the net profits from McLaughlin's exhibitions. Although the agreement between them is dated 14 May, a supplemental agreement with Harris, dated 8 May, transferred his rights under the contract back to Edison. This was so a new arrangement could be made with John Hickling, a New York banker and broker, who agreed to fund McLaughlin's trip. On 10 June, McLaughlin and Hickling signed an agreement with Edison for the same terms as the earlier contract as well as a supplemental agreement allowing them to purchase Edison's entire rights to Australasia for $17,500 cash by 31 July. They expected to raise this money in England, but after arriving in London, discovered that "the instruments used by the Stereoscopic Association are considered here as more complete than those we brought over and no encouragement has been given leading to the hope of disposing of the rights for Australasia." They also decided to abandon McLaughlin's proposed exhibition business for Australasia and returned to the United States. Agreements between Edison, McLaughlin, and Harris, 8 and 14 May 1878; agreements between Edison, McLaughlin, and Hickling, 10 June

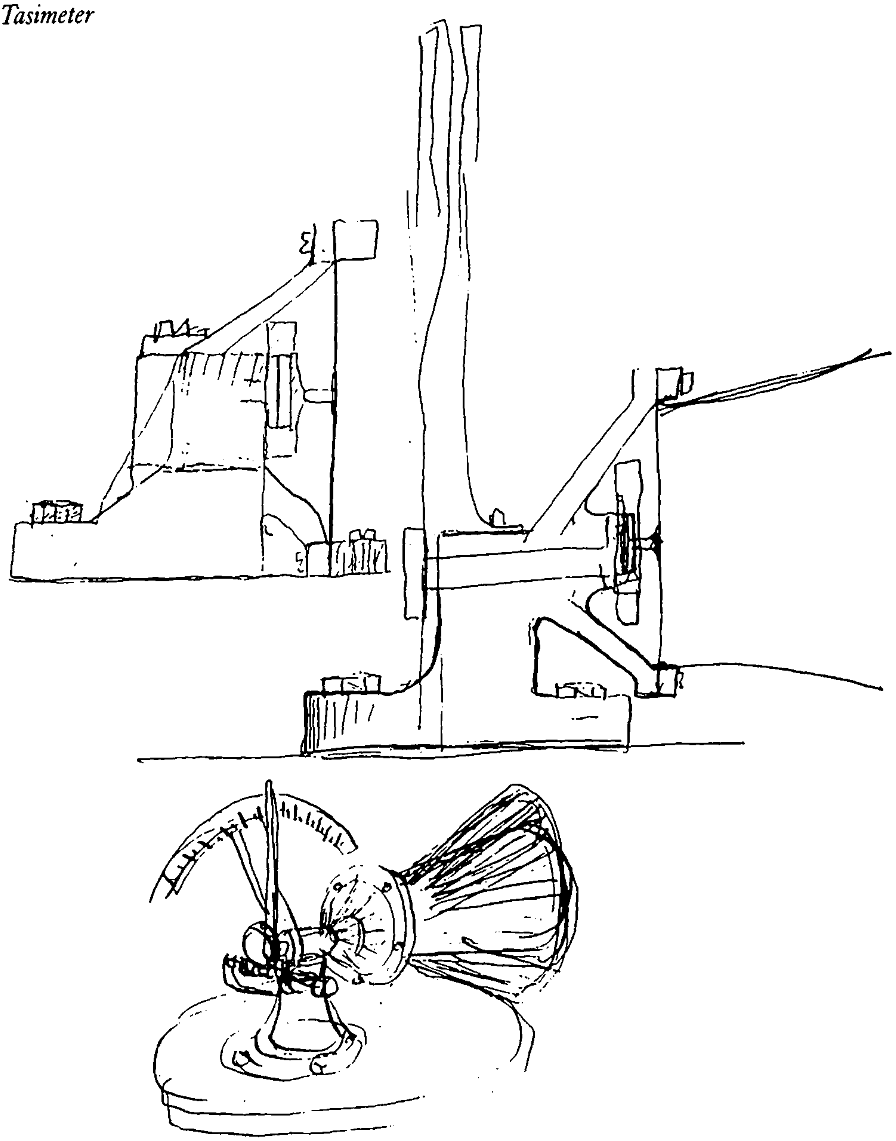
1878; all Miller (*TAEM* 28:1102–4, 1127); agreement between Edison, McLaughlin, and Hickling, 11 June 1878; Hickling to TAE, 15 July 1878; Lemuel Serrell to TAE, 18 June 1878; all DF (19:254, 280; 18:712).

-1329-

[Menlo Park,] May 16 1878

Notebook Entry: Tasimeter

Carbon Electro-Thermometer[1]



X, NjWOE, Lab., NS-78-009 (*TAEM* 7:886).

1. The term "carbon electric thermometer" was apparently suggested as a replacement for "heat measurer" (see Doc. 1289 n. 3) by George Bliss during his visit in early May (undated memos of names in Cat. 1029:17, Scraps. [*TAEM* 25:170] and 78-035, DF [*TAEM* 19:449]). A device labeled "Thermo Carbon Electrothermometer" is on the same page as a 1 April drawing of a "Small cast iron Transmitter" but appears to be a later addition (Vol. 14:78, Lab. [*TAEM* 4:221]). An account book entry headed "Carbon Thermometer" includes entries between 29 May and 7 June; another entry headed "Micro Tasimeter" begins on 14 June (Cat. 1185:179, 223, Accts. [*TAEM* 22:636, 656]).

This drawing shows the second style of tasimeter Edison designed (see Doc. 1316 for the first). He drew another version of the design two days later. On 12 June, Batchelor made a measured drawing of the instrument for the laboratory machine shop. It was first used by Edison during the solar eclipse expedition to Rawlins, Wyo., at the end of July. NS-78-009, Lab. (*TAEM* 7:887, 891); Doc. 1373.

-1330-

To Samuel Edison

Menlo Park, N.J.[a] May 18 1878.

Dear Father

How would you like to go to Europe with Simonton[1] If I pay your fares= Yours

TAE

ALS, Hummel. [a] Place from Edison's laboratory handstamp.

1. James Symington was deputy sheriff and constable in Port Huron and had just become an agent for the National Publishing Co. On 14 May he had written Edison that Samuel wanted to visit Europe, particularly Amsterdam to investigate the family genealogy. Seeking to disengage Samuel from his relationship with Mary Sharlow (see Doc. 421 n. 3), Symington suggested that if "you was to send him to Europe upon such a mission or whatever you might contrive I have enough of mannagemet to get [her] married to some widdower or some low rascal who could easily be tempted to marry her for 300 dollars." Symington and Edison's father did not make the trip at this time, but Thomas did pay their expenses for such a trip in 1885–86. Symington to TAE, 14 May 1877, 24 Nov. and 21 Dec. 1885; 20 Jan. and 20 Nov. 1886; Samuel Edison to TAE, 30 Oct. 1885; all DF (*TAEM* 15:658; 77:468, 470, 478; 79:249, 272).

-1331-

To William Preece

Menlo Park, N.J.[a] May 19, 78

Friend Preece,

Yours received.[1] I am glad of the success before the Royal[b] Society=[2] Please tell Adams to write in detail the nature of the difficulty there= Do Telephones work well on resistance= If the static charge is the bug I will go for a compensation= Here we whisper from NY to Phila 24 wires on the pole 4 cables, & all the net work of wires in the main offices at NY & Phila. Now my dear Mr. P. I am completely stuck on your patent law there. Myself and Solicitor cannot for the life of us see what to disclaim= As shown in the patent the phono is the recorder of the telephone, and forms a part of it. I would be a great favor if you would jot[b] down you idea of the points to be disclaimed= Do you want a copy of WU contract with me on telephones $6000 per year for 17 years'= In Nature I see Hughes has discovered that some substances are sensitive to sound like selenium is to light=[3] Evidently Mr H dont read the papers that is nothing but my carbon telephone= he varies the resistance by disturbing the pressures thats all & Il bet £100 on it= Hyperoxide of lead Iodide Copper, metallic[b] sulphide— Black ox manganeese & many other ~~things~~ semi conductors will replace my Lampblack button but they are all inferior= please do not let[b] Mr Hughes unconsciously go for me & rediscover what cost me so much experimenting= From Ellis' note in Nature I infer that the phonos over there do not work very well= because here, we read a newspaper backwards and then bring in a person to listen if he gets every word it is OK if not it isnt properly adjusted= I think the Quadruplex matter will soon be fixed up with Smith Fleming & .Co=[4]

I hope in two weeks to send you something new— ~~an~~ no patent (Im weakening on English patents) purely scientific Elegant. Yours

T A Edison

ALS, UkLIEE, WHP. [a]Place from Edison's laboratory handstamp. [b]Obscured overwritten letters.

1. Not found.

2. No reports of this have been found.

3. David Hughes (1831–1900) was a London-born electrician and inventor. He was educated in the United States, where he taught music and began research in acoustics that led to his invention of a synchronous printing telegraph system. Hughes returned to Europe in 1859 to promote his invention, finally settling in London where he continued his electrical experiments. *DAB,* s.v. "Hughes, David Edward"; Marsh 1980; Marsh and Roberts 1979.

An unsigned notice in the 2 May issue of *Nature* (18:20) stated that Hughes

> has made the wonderful discovery that some bodies are sensitive to sound as selenium is sensitive to light. If such a body be placed in the circuit of a small battery it will be so affected by the sonorous

> vibrations when spoken to as to replace entirely the transmitter of a Bell telephone. Conversation, music, and all the sounds transmitted by an ordinary telephone are easily reproduced. A mere scratch with the finger-nail, or a touch with the soft part of a feather is distinctly transmitted. The sonorous vibrations produce strains in the conductor, which cause variations in the resistance of the circuit, and thereby produce similar variations in a current flowing through that conductor.

The photoelectric characteristics of selenium had been discovered five years earlier and were the focus of continuing investigation. Willoughby Smith, "Selenium, Its Electrical Qualities and the Effect of Light Thereon," *J. Soc. Teleg. Eng.* 6 (1877): 423–48; Edison's Menlo Park Scrapbook No. 18, "Phenomena General," contains many related notes and articles (Cat. 1028, Scraps. [*TAEM* 25:119]).

4. See Doc. 1336 n. 3.

-1332-

To Theodore Puskas

MENLO PARK, N.J.[a] May 19= 78

My Dear Puskas

I closed Australisia today= good parties, man leaves for Australia; 1st June to exhibit=[1] I send copy of contract by next mail,= As we can get no patent in China & Japan I am making arrangements here to start a man[2] at once to head off any others as I understand other parties intend going there= How about India. I think I can place it here= Preece & others keep talking about English patent= Preece says as it stands it isnt worth a dam—= I differ with him= I desire that the points that are to be disclaimed should be pointed out The phonograph in that patent is only a Telephone receiver & is very properly a part of it= Please consult with some one there about it & let me know= My Telephones are meeting with great success here. I hear Adams is sick in London[3] & has not done much owing to their lines. I sent him a lot of improved telephones= W. U. Telgh Co are starting a Central Station system with my Telephones.[4] Exhibition of phonograph in Boston netts $4300. per day, in NY about 80 to 100 per day and 75 more parties are starting out over the Country to exhibit on a royalty= I am making an improved hand machine for exhibition purposes that will be splendid= will send you one= The clockwork cylinder machine is running to day & works splendid I shall probably ship it next Saturday to you ~~in~~ at London= Heard you had a quarrell with Nottage what was it about= have invented several new things since you left= Do not judge of the Carbon telephone from results in

England= Its success here goes beyond anything that I had ever imagined. It is cheaper than any other telephone= Please write and let me know what you are doing= I received your telegram about France started OK=[5] more anon Yours Truly

T A Edison

ALS, HuBPo, TP. [a]Place from Edison's laboratory handstamp.

1. See Doc. 1328 n. 6; Frank McLaughlin did not sail until 15 June. TAE to Puskas, 3 July 1878, TP.

2. Edison may have been referring to E. W. Kellogg of Hartford, Conn., who had made several inquiries about exhibiting the phonograph in China and Japan. See Doc. 1372.

3. See Doc. 1338 n. 2.

4. Edison is probably referrring to Gold and Stock Telegraph Co.'s new "merchants' exchange, for connecting express, steamship, railway and other companies, merchants, lawyers, banks and private individuals by means of private lines with a central office, and through that office with each other and worked with Edison Telephones and printing instruments." Gold and Stock designed this service so that "both telephones and printing instruments will be used on what is known as the Philadelphia plan. By this plan, subscribers are, by means of switches, enabled to communicate directly with each other, and each can, if he desires it, send and receive his W. Union messages over his private line." At the end of May the company ordered 500 Edison carbon telephones, apparently for use in this service. American Speaking Telephone President George Walker noted that "the Edison instrument dispenses with the call box, and we hope to be able to rent it, at as low prices as those of Bell Company." Gold and Stock advertisement, *New York Herald,* 8 Sept. 1878, 13; American Speaking Telephone Minutes, 35, 38–39; G&S Executive, 184; see also Doc. 1390 n. 1.

5. The undated telegram reads: "France started OK—posted letter." The letter has not been found. DF (*TAEM* 15:580).

-1333-

From George Bliss

Chicago, May 19th, 1878.[a]

Dear Sir:

Thanks for your kind letter of the 16th.[1]

I shall be glad when the phonograph matter is finally arranged.[2]

I have been staking everything on my relations with you[3] in spite of the sneers of others at Patent rights and much underhand opposition.

I expect the day will come when you will enjoy a magnificent income.

The Siemens Bros. of London have a monthly income of 60.000 pounds from their patents.[4]

Puskas & Roosevelt have certainly made a scoop in a France at which I am immensely delighted.[5]

My exhibition phonographs have not come yet but expect to be under full headway by the middle of the week.[6]

The public interest is intense. Respectfully,

Geo. H. Bliss Gen. Man.

Barton[7] is in New York. Buzz him on finances.

Gilliland[8] is here and wants to sell his factory. I think it will be a good thing to buy soon.

TLS, NjWOE, DF (*TAEM* 15:678). Typewritten in upper case. Letterhead of Electric Pen and Duplicating Press Co., George Bliss, General Manager; letterhead and dateline are electric pen copy. [a]"Chicago," and "1878." preprinted.

1. Not found.

2. Bliss had been trying to obtain the Illinois concession from the Edison Speaking Phonograph Co. and had periodically asked Edison's help. He believed the matter had been settled in April and expected Edward Johnson to ship him a large phonograph on 1 May, but found Johnson becoming "non-comittal." On 16 May, however, Bliss reported to Edison that "the Phonograph people have awarded Illinois to me." Bliss to Gardiner Hubbard, 18 Apr. 1878, NjWAT, Box 1151; Bliss to TAE, 16 May 1878, DF (*TAEM* 15:672).

3. On 11 May, Bliss wrote Edison that he had sold his stock in Western Electric and resigned as a director. The previous day, Bliss had written Gardiner Hubbard that he had turned down two other business offers in expectation of receiving rights to Edison's phonograph. Another letter to Hubbard on 13 June indicates that Bliss was not quite "staking everything" on his relationship with Edison. At the time, he was negotiating with the Bell Telephone Company for rights to Illinois. However, on 29 June, Bliss informed Hubbard that Charles Holland, his partner in the electric pen business, was insisting that he give all his time to that effort. As Bliss could not escape his electric pen obligations "without a loss of $6,000," he felt "constrained to drop the Bell telephone matter." By mid-June he had also sold out his rights to the phonograph in Illinois, except in Chicago, where he managed the day exhibits. Bliss to TAE, 11 May and 10 June 1878, both DF (*TAEM* 15:644, 775); Bliss to Hubbard, 10 May, 13 and 29 June 1878, Box 1151, NjWAT.

4. Siemens Bros., a London firm headed by Charles William Siemens, produced and installed submarine telegraphic cables and other electrical equipment (see *TAEB* 3:171 n. 2). No source has been identified for the number.

5. Bliss may have been referring to a 3 April agreement between Puskas and Cornelius Roosevelt (TP). Under its terms, Roosevelt had "the Exclusive agency for France & its colonies for the sale of Phonographs," which he was to purchase from Puskas at the rate of 100 per month. It also reserved for Puskas the right to sell phonographs at the Paris Universal Exposition.

6. At least his first (he ordered three in May and four more in June) arrived a day or two later. Its removal from the crate and initial operation were described in the *Chicago Evening Journal* of 21 May. "The Modern Miracle," Cat. 1029:99, Scraps. (*TAEM* 25:214); Edison Speaking Phonograph Co., royalty accounts for May and June 1878, DF (*TAEM* 19:179, 183).

7. Enos Barton.

8. Ezra Gilliland had worked with Edison as a telegrapher in Adrian, Mich., and Cincinnati. In 1875 he formed Gilliland & Co., with Edison as a partner, to manufacture electric pens and presses as well as telegraph instruments in Newark. This firm was dissolved in 1877. In the spring of 1878 Gilliland was a partner with W. C. Ross in the Cincinnati Electric Works. See *TAEB* 1:16, 2:544 n. 1; Gilliland to TAE, 18 Mar. 1878, DF (*TAEM* 15:367).

-1334-

From James Partrick

Philada May 21 1878

Dear Edison

Mr Gilliland was here last night[1] examined our work upon ~~Telephones~~ Phonographs[a] we are making for the Phonograph Co of New York.[2] Says the Company propose having one hundred manufactured and he will do all he can to get us the contract as our work so far is decidedly the best out.= I will be in New York Thursday morning with one of our machines, now if you can be over there and give ~~give~~ us a lift in way of obtaining us this order you will be doing us a big favor or if you can write us a letter to Johnson that will attain the desired object (providing our work proves satisfactory to your and other inspection) it will be all the same.= You know best who controls this work and therefore can tell best who to write to or see= How about the Telephones we would like to pitch into about a hundred pair now or would like when you get the Standard Phonograph done to try a lot of them for you.=[3] Allow me to congratulate you upon the sale of Telephone "well done"= Hoping to see or hear from you before long— I remain yours Respy

Jas Partrick for P.&.C[4]

ALS, NjWOE, DF (*TAEM* 19:72). [a]Interlined above.

1. Ezra Gilliland then went to New York where he obtained for himself and his father an exclusive license to exhibit the phonograph in Ohio. A few days later James Redpath wrote that Gilliland was in New York and "has been teaching our operators here—and understands the machine as well as Mr. Edison himself." Agreement between Ezra and Robert Gilliland and the Edison Speaking Phonograph Co., 21 May 1878; Redpath to Charles H. Fiske, 25 May 1878, EPS Lbk. 2:99–100; both UHP.

2. Partrick & Carter made at least twenty-six instruments in their Philadelphia shop during May. They are probably similar to the twenty-six Greenfield phonographs (see Doc. 1276 n. 1), which were made entirely of iron, including the cylinder. It is unclear how many Partrick & Carter manufactured, but by the end of June eighty large phonographs had been made. The additional thirty-eight were probably manufactured by Partrick & Carter, although S. Bergmann & Co. may have begun manufacturing or altering instruments in New York by June (see Bergmann & Co. bill to Edison Speaking Phonograph Co., 1 July 1878, Box 4, UHP; and Doc. 1419 n. 2). By the end of June, seventy-three of these instruments had been sold for $100 each, which included supplies. Edison received his 20% royalty only on the actual selling price of the instrument ($95.50). Johnson to Partrick & Carter, 20 and 29 May and 1 June 1878; Partrick & Carter bills to Edison Speaking Phonograph Co., 18 June 1878; all UHP; Edison Speaking Phonograph Co. royalty statements for May and June 1878, all DF (*TAEM* 19:181–83).

3. In June, Edison ordered twenty-five telephones from Partrick & Carter. See Doc. 1355.

4. James Partrick, a former telegrapher who had served as treasurer of the National Telegraphic Union, had formed the Philadelphia telegraph manufacturing firm Chester, Partrick & Co. in 1867. He later formed Partrick, Bunnell & Co., with offices in Philadelphia and New York, and when Jesse Bunnell set up an independent shop in New York in early 1876, he formed Partrick & Carter. "A New Firm," *Telegr.* 4 (1867): 99; advertisements for these firms in ibid. 4–12 (1867–76), passim.

-1335-

From Marion Page

Milan May 23 [1878]

Dear Brother

I received your "Photo" all right and for which I sent you many thanks— I think it very good of you indeed

Everyone is very anxious to have you come to Milan they will give you a grand reception

Hundreds have already been to see the old house where you was born

Homer[1] is getting so he can walk arround he came very near being killed— I wrote Mary about it[2]

I tell you Rinkey you ought to come to Milan and bring a Phonograph write to me again where is father what has Pitt gone to the Hot Springs for

Love to all Ever your loving Sister

Marion[3]

Write again wont you?

ALS, NjWOE, DF (*TAEM* 17:562).

1. Marion's husband, Homer Page. The cause of his disability is unknown.

2. Mary Stilwell Edison; letter not found.
3. Marion Page (1829–1900) was Edison's oldest sister.

-1336-

From George Gouraud

London 24 May 1878[a]

T. A. Edison

They[1] confident of rights under original contract but recognize expediency of compromise after much discussion am of opinion if authorized by you can close on following basis Out of first receipts you to be repaid your expenses five hundred pounds next they to be repaid their expenses hereafter incurred on same account after which you to receive first five hundred pounds yearly then they to receive five hundred pounds yearly then you other five hundred pounds anything further theirs better cable reply expedite promised map[2] Persuade Prescott to approve and promptly—as parties all here and moment exceptionally favorable for opening campaign[3] cable Nottage to consult me regarding England

Gourad

L (telegram), NjWOE, DF (*TAEM* 19:520). Message form of Direct United States Cable Co., Ltd. [a]"187" preprinted.

1. Smith, Fleming & Co.
2. That is, a proposition map, or a chart outlining terms of the proposed agreement. George Prescott to Gouraud, 29 May 1878, DF (*TAEM* 19:526); *OED*, s.v. "map," 1b.
3. Gouraud had been trying to move Prescott toward a settlement since April. Prescott was also negotiating quadruplex rights with the British Post Office, which depended on reaching an agreement with Smith, Fleming & Co. This matter remained unresolved until at least December, when Prescott suggested to Edison that they place further negotiations in the hands of Henry Weaver, Esq. Prescott to Gouraud, 22 Apr. 1878; Gouraud to Prescott, 23 Apr. 1878; Prescott to TAE, 23 Dec. 1878; all DF (*TAEM* 19:503, 506, 577).

-1337-

From George Scott

[New York,] May 25/78[a]

Friend Edison

To my astonishment this am the enclosed transmitter would not "transmit." After trying everything, I unscrewed it & found the glass disc cracked into 3 pieces—[1] having none exactly like it I replaced it by a micro-glass cover which however seems to do no good—

The other Transmitter is OK & has today worked from 197 Bway to my house in Brooklyn thro all obstructions.— I therefore think it will be a success— Please return me the enclosed Transr in good order quickly as possible so I can demonstrate the whole thing on monday— Yours in haste

G.S.[2]

⟨for Batchelor WC⟩[b]

ALS, NjWOE, DF (*TAEM* 19:713). [a]Obscured overwritten letters. [b]Written by William Carman.

1. Edison placed a glass disk between the diaphragm and the carbon button in his transmitter (see Docs. 1278 n. 2 and 1351).

2. George Scott had been superintendent of Gold and Stock Telegraph Co. since 1872. Gold and Stock had the exclusive right to manufacture, sell, and lease telephone instruments protected by Western Union patents. "The Gold and Stock Telegraph Company," *Telegr.* 8 (1871–72): 307; *TAEB* 3:644 n. 1.

-1338-

To Henry Edmunds, Jr.

MENLO PARK, N.J.[a] May 26 1878.

My Dear Mr Edmunds

Yours of the 15th received,[1] since the date of your letter, Preece Telegraphed me that Adams was all right again and off to Paris.[2] I am very much grieved at the Hughes article in the Engineering.[3] That Mr Preece should announce before the B.A. my discovery of the variation of resistence of Carbon & other semi conductors by pressure[4] and the same fact published ~~B~~ broadcast for over two years and within the last 6 months of the Great success of[a] my Carbon Telephone, & Adams in England with the apparatus ~~th~~ it is incomprehensible that the article should appear giving the credit to Hughes it is not coinvention because after a thing is known all over the world for two years its sudden reinvention is clear stealing. Months ago your telegraphic journal published & illustrated my pressure relay=[5] All of the experiments of Hughes made by me two years ago incidentally to the perfection of my telephone— The Wheesy sound of his devices was the great difficulty that I had to eliminate= The Grating of wires when disturbed does not give articulation & his statement that certain substances are sensitive to sound is all bosh & is refuted in the very same article [-][b] 2nd p. in 2 column [bot?] pp[6c] & any disturbance of the ~~metal~~ Connecting junctures must increase or decrease the pressure= In my English patent the whole thing is shewn=[7] It is a notorious fact in this Country that G M Phelps Supt of the WU Tel shops was the inventor of the Hughes apparatus[8] so it is only his second attempt= I telegraphed the Engineering about it & have sent them the papers=[9] I am afraid I bore you with this but I cannot help it as its rather rough to ~~see~~ work[d] two years ~~labor~~ to discover & fact & then have it stolen without[e] comment especially in England where I want to stand well=

If you will do what you can to set this matter right, I will reciprocate in such a way that you will not ~~regrent~~ regret[d] it= in haste I am Yours truly

Thos A. Edison

Scribners monthly for March or April has my carbon telephone=[10] also telegraph journal (Am[erica]n)[11] some time ago

P.S. I have something fresh

ALS, Pritchard. [a]Place from Edison's laboratory handstamp. [b]Canceled. [c]"[-] 2nd . . . pp" interlined above. [d]Interlined above. [e]Obscured overwritten letter.

1. Edmunds had written Edison on 15 May that Adams had caught cold at Easter and was "laying sick at the Hospital, he has had a bad attack of inflamation of the Bowels—but is now much better." Adams had asked Edmunds to write Edison "to see his wife & tell her not to be uneasy about him." DF (*TAEM* 15:668).

2. On Monday, 27 May, Preece wrote Edison that he had

> telegraphed to you on Friday to say that Adams was all right again and I believe he went to Paris on Saturday. He has had a very severe bout of it and it will take him some time before he gets perfectly straight The fact is his heart is very much diseased and the doctor says that any sudden shock or disappointment might be fatal to him. I have not liked to tell him much about the failure of the experiments here for fear it might hurt him. The sooner he returns to America the better and I should advise you to keep him there when he does return. [WHP]

3. The 17 May issue of *Engineering* (25:384) contained a copy of David Hughes's paper, "On the Sonorous Vibrations in Varying the Force of an Electric Current," read before the 9 May meeting of the Royal Society of London (Hughes 1878). In this paper Hughes claimed that he had discovered that carbon and other semiconductors varied their resistance under pressure. The 10 May issue had carried an article about the experiments and the claims in Hughes's paper under the title "The Hughes Telephone" (25:369).

4. Preece 1877.

5. This had appeared in the 1 July 1877 issue of the London-based *Telegraphic Journal and Electrical Review* (5:149–50). It is a reprint of the account that appeared in the 1 June 1877 issue of the Western Union–sponsored *Journal of the Telegraph* (Doc. 926).

6. Edison appears to be referring to the fifth and sixth paragraphs of Hughes's Royal Society paper (Hughes 1878).

7. Brit. Pat. 2,909 (1877); see Doc. 973.

8. George Phelps rendered Hughes's printing telegraph practical for use on telegraph lines in the United States (Israel 1992, 52–53). On 6 June, Henry Bentley wrote Edison, encouraging him to "Go for the robbers. Phelps told me yesterday how Hughes treated him some years since in printing telegraph matters" (DF [*TAEM* 19:719]).

9. The 5 July issue of *Engineering* (26:13) contained the statement that on 27 May, "telegrams were received by Sir William Thomson, Mr. W. H. Preece, and ourselves from Mr. Edison, the object of which was not only to assert his claim, by priority, to the discoveries of Professor Hughes, but to convey the unworthy insinuation that Mr. Preece had been guilty of a gross breach of confidence and friendship, and had joined with Professor Hughes in a conspiracy to rob Mr. Edison of his rights as a discoverer" (Cat. 1240, item 790, Batchelor [*TAEM* 94:296]). Although Edison apparently cabled Preece on 27 May (see Doc. 1339), the editor of *Engineering* seems to be confusing Edison's 4 June cables to both Preece and Thomson (Docs. 1347 and 1346) with whatever he cabled to Preece on 27 May. In its 5 July issue, the journal also selectively used the material that Edison had sent in a manner that further incensed him (see Doc. 1375).

10. Prescott 1878a.

11. Prescott 1878e.

-1339-

From George Ward

NY. 27th May 78

Friend Edison

Dr. Muirhead[1] looked further into Hughes' publication[2] after you left & we talked it over.— He ~~thinks~~ says ~~Hu[-]~~[a] it is undoubtedly your principle and he thinks, under the circumstances you should set to work immediately and [----][a] make new Telephones in this form or an improved one[b] and call it your improved instrument.—

Preece has no doubt got your message this morning—[3]

Dr Muirhead expects to be here on Wednesday you had ~~perhaps~~ better see him again as he has cabled particulars of this affair to ~~C~~Latimer Clark—[4]

Excuse haste Yours very truly

Geo G. Ward[5]

⟨Bless your soul Hughes cant get good articulation except in the way I have arranged it. Barker at Phila has tried Hughes & its all wheesy just what Ive been working to get over since 1876. Hughes has not improved my principle he is only starting up what I started in 187~~5~~6⟩

ALS, NjWOE, DF (*TAEM* 15:704). [a]Canceled. [b]"or an improved one" interlined above.

1. Electrical engineer Alexander Muirhead (D.Sc., University of London) was a director of and chief scientific adviser for Latimer Clark, Muirhead, & Co. (an engineering firm co-founded by his father, John Muirhead). Together with H. A. Taylor, he had developed the basic system for duplexing undersea cables, which he, Taylor, and the firm's manager (his older brother John Muirhead) had just installed for the United States Direct Cable Co. He and Ward had visited Edison at Menlo Park on 22 May. *DNB*, s.v. "Muirhead, Alexander"; "Obituary. Muirhead," *Engineering* 40 (1885): 268; "John Muirhead," *Proceedings of the Institution of Civil Engineers* 126 (1898): 399; Ward to TAE, 18 and 21 May 1878, DF (*TAEM* 15: 677, 690); "Edison and His Inventions," *Boston Journal*, 25 May 1878, Cat. 1240, item 622, Batchelor (*TAEM* 94:212).

2. Hughes 1878.

3. According to the 5 July issue of *Engineering* (26:13), Edison had sent a telegram to Preece on 27 May regarding his support of Hughes's claims, but it has not been found. In a 22 May letter that Edison had not yet received, Preece had written that

> the recent discoveries of Professor Hughes have thrown your telephone completely in the shade. Hughes's doings border so closely upon yours that it is difficult to distinguish between what you have done and what he has done. You were on the very threshold of a great discovery, in fact, had it not been for the Phonograph distracting your attention you must have anticipated what Hughes has done. You must have seen the papers and know exactly what he has done and therefore it is useless my going into the matter. I have not tried it practically and have only seen his results; which are certainly startling. I am going to bring them before the Society of Telegraph Engineers tomorrow night and will send you a report as soon as it is printed.

Preece added that he was glad Edison had already closed a contract with Western Union, "for Hughes having thrown his invention open to the world makes it rather awkward for patentees like yourself." Copies of this letter are in WHP and in the David E. Hughes Papers at the University of Manchester, England, with a notation indicating that Preece sent it to Hughes.

4. Josiah Latimer Clark was a founding partner of Latimer Clark, Muirhead, & Co. (see note 1). Edison had met Clark in London in 1873. He was a British civil engineer and electrical expert best known for his work in submarine telegraphy and in the establishment of standard units of electrical measurement. Docs. 369, 411, 418; *DSB*, s.v. "Clark, Josiah Latimer."

5. George Ward was American manager of the Direct United States Cable Co. Reid 1886, 526.

-1340-

From George Gouraud

London 28 May. 1878[a]

Dear Sir,

Phonograph.

I have not yet been able to see Puscus— He had an interview the other day with Nottage who again volunteered several expressions indicating dissatisfaction at having to work with Puscus— There is something about Puscus's manner which evidently irritates Mr Nottage and I earnestly advise you'r not giving Mr. Puscus any further powers than he already holds in connection with your phonograph matters in Great Britain at least— Nottage mentioned incidentally that under his contract with you you had no right to participate in any receipts from exhibiting the phonograph—[1] I expressed surprise at this, affecting to really know more about your contract than I do— I think you may count upon Mr. Nottage recognizing a moral right at least and that you will receive some share of the proceeds which are calculated to be very large—if the exhibition part of the thing be organised with intelligence & carried out with activity— I am in consultation with Nottage at this moment with respect to a campaign of this sort which will at once bring extensive free advertizing & open the way for orders for large numbers of machines— Please send me copy of your contract with Puscus which you were good enough to offer me when in N.Y.[2]

Also I beg you give attention to the other matters in this connexion concerning my interest in your royalties here which I am satisfied I can be the means of very greatly increasing if I have any inducement to do so Yrs respectfully

Geo E Gouraud [pr H.?][b]

L, NjWOE, DF (*TAEM* 19:243). [a]"London" and "187" preprinted. [b]Illegible.

[1] Edison's 22 March agreements with Nottage and Howard John Kennard established royalties on the manufacture and sale of phonographs. There were no provisions for exhibition receipts. Miller (*TAEM* 28:1080, 1086).

[2] Puskas's 16 April contract with Edison authorized him to examine the London Stereoscopic and Photographic Co.'s books and collect royalties and fees on Edison's behalf. It also entitled him to a one-third share of the company's payments to Edison. TP.

-1341-

Caveat: Phonograph

[New York,] May 29, 1878[1a]

To all whom it may concern.

Be it known that I, Thomas Alva Edison of Menlo Park in the State of New Jersey United States of America Electrician, have invented, certain new and useful Improvements in means for Recording Sounds and in Reproducing such Sounds from such Record, and I do hereby declare that the following is a full clear and exact description of the same.

This invention consists in means for recording in permanent characters the sounds made by the human voice in speaking and singing, those made by musical instruments, birds animals or any sound whatever, and in means for reproducing those sounds at any desired time. The sound vibrations act upon a diaphragm or other body capable of motion; this diaphragm is at the back of a chamber provided with an opening or mouth-piece, and to this diaphragm an indenting point is secured. This instrument I term a "Phonograph." The phonograph is adjusted to position with its indenting point contiguous to a moving surface covered with a thin sheet of metal foil or other suitable material, or else the surface with the metal foil is stationary and the phonograph movable. The surface upon which the metal foil is secured is by preference grooved spirally and the indenting point indents the foil in the line of this groove as the diaphragm is moved back and forth by the sound vibrations, these indentations are a record of the sound waves and form the characters for reproducing the sounds. This indented sheet I term a "Phonogram."—

The instrument or portion of the instrument that reproduces the sound from the phonogram I term a "Phonet It is similar in construction to the phonograph, being provided with a diaphragm and point, but the mouthpiece is by preference funnel shaped to render the sound loud and distinct.—

The sounds are reproduced by the phonet being adjusted to place so that the point of its diaphragm is at the beginning of the spiral line of indentations and as the surface containing the indented foil is moved, the diaphragm of the phonet is vibrated by the point passing from one indentation to the next, hence the diaphragm receives the same movement from the indentations as when making those indentations, consequently the sounds made by the phonet will be the same as those that operated upon the diaphragm of the phonograph.

In the drawing Fig. 1 is a section of the phonograph and sectional elevation of the mechanism for presenting the surface to be indented, and Fig. 2 is a plan of the same.[2]

Fig.[b] 1.

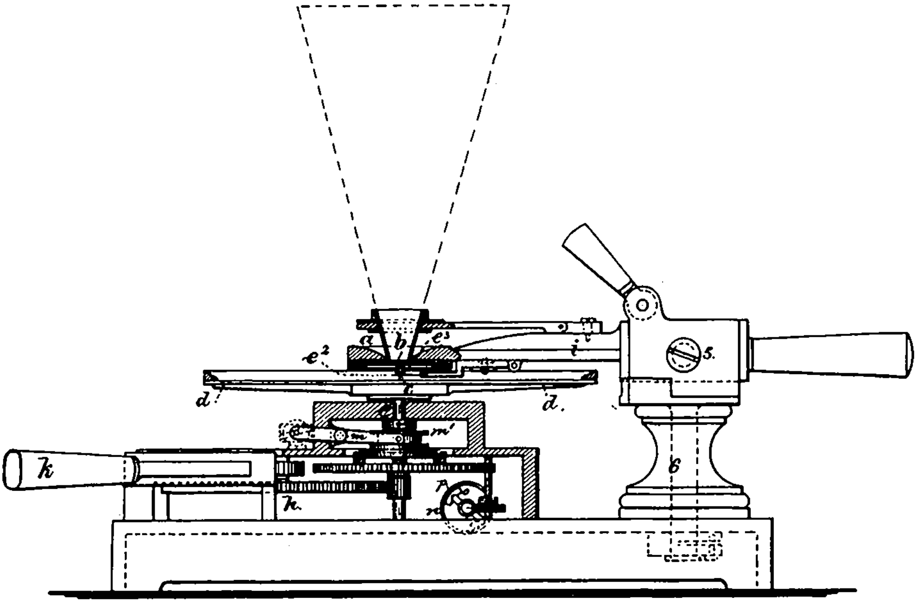
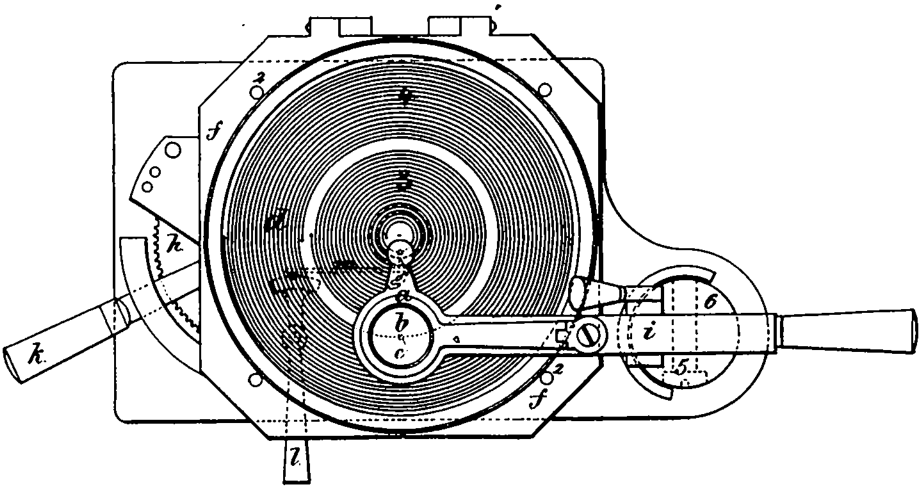


Fig. 2.



The phonograph is made of the body portion a diaphragm b and indenting point[3] c. The body portion a has a central opening forming the mouth-piece into which the person speaks or through which opening the sound vibrations pass to act upon the diaphragm and the diaphragm is secured at its edges to the body a leaving a space between the body and diaphragm in order that the diaphragm may vibrate freely.— The indenting point should be a diamond or other very hard substance The diaphragm is made of a thin sheet of iron or other material and it is preferable to place the indenting point upon a delicate spring arm e^2 and to employ a short piece of rubber tubing e^3 between the spring and diaphragm, this rubber acts as a damper to prevent false vibrations of the diaphragm— The phonograph is upon a lever arm i pivoted at 5 to the vertical stud 6 so that the phonograph may be raised or lowered vertically or moved horizontally for a purpose hereafter explained—

It is now to be understood that if a person speaks with his mouth near the mouth-piece of the phonograph, the sound vibrations will act upon the diaphragm and vibrate it and communicate to the indenting point a similar movement, and that if a piece of metal foil or other material susceptible of being indented is placed beneath or behind the indenting point and caused to move regularly, or the indenting point moved over the material, that said material will be indented and form a perfect record of the sound vibrations I will now describe the means for sustaining the sheet to be indented and the mechanism for moving the same

d is a disk or plate secured to and turning with the shaft[4] e and hinged to this disk is a ring-frame f: this disk d has two spiral grooves 3 4 in its surface

There are pins 2 2 upon the surface of the disk and holes at corresponding places in the ring-frame; the sheet to be indented is of a size and shape to correspond with that of the disk d and frame f and said sheet has holes in it corresponding to the position of the pins 2 2 and these holes form register marks in placing or replacing the sheet upon the disk d and after the sheet is so placed, the ring-frame f is brought down upon the sheet and holds it firmly in place. There may be a central opening in the indented sheet of a size slightly larger than the space occupied by the spiral 3 and the outer edges of the sheet are stiffened by a ring of thick paper or paste-board caused to adhere by glue or other adhesive material. The surface of the disk d is made with two spiral grooves 3 and 4 as aforesaid, the groove 3 is a guide for a pin that is upon an arm[5] g on the phonograph and the groove 4 is for the indenting point c.

As the disk and sheet are revolved, the groove 3 causes the indenting point to occupy a position immediately over the line of the spiral 4 and the indentations will be made upon the sheet of foil in a line corresponding to that of the spiral 4 shown in fig. 2.

The indentations made in the foil are a complete record of the sound vibrations that acted upon the diaphragm b and from this indented sheet which I term a "phonogram," the sounds are reproduced.

The phonograph is carried outwardly by the spiral 3 and in so doing the parts swing upon the vertical stud 6 By depressing the outer end of the lever i the phonograph is raised so that it can be swung aside from the disk d to allow of the ring-frame f being thrown back and the indented sheet or "phonogram" removed from the disk.

The shaft e is revolved by a weight or spring and gearing at h and the spring is wound up by moving the lever k back and forth which acts upon a ratchet and pawl of ordinary construction. l is a lever provided at its outer end with an inclined groove in which is a pin on the lever[6] m and the other end of this lever m is connected with the coupler m^1 by moving the lever l one way or the other, the shaft e will be connected to or disconnected from the gearing h and hence the disk d stopped or started at pleasure without interfering with the motor.

As it is necessary that the shaft e should be revolved with uniformity, I provide a governor at n to prevent the apparatus revolving too rapidly and this may be made as in figs 1 3 & 4 in which there are metal blocks o at the ends of spring arms from a crosshead on a shaft that is driven by the gearing h said blocks swinging radially and acting against the interior of a stationary cylinder p if the speed becomes too great, thereby checking the speed by the friction of the blocks against the cylinder.

Fig. 3.

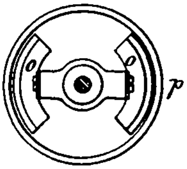


Fig. 4.

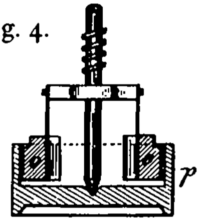
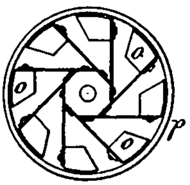


Fig. 5



These spring arms may be secured at one end to a prismatic block as shown in fig. 5. It is preferable to cover the surface of the blocks o next the cylinder p with felt or similar material that will slide upon the interior surface of the cylinder p but produce more or less friction according to the centrifugal action—

The guide spiral 3 may be dispensed with and either of the devices shown in figs 6 7 8 or 9 made use of

Fig. 6.

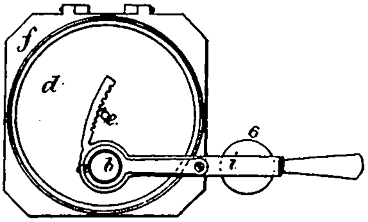
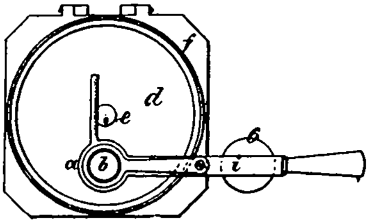
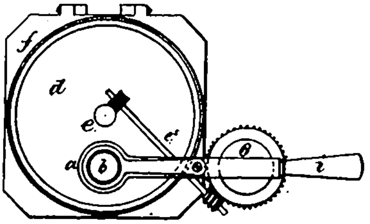


Fig. 7.



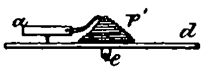
In figs. 6 and 7 the shaft e projets above the surface of the disk d and there is a tooth upon the shaft contiguous to a rack-bar extending from the phonograph, hence each revolution of the shaft the rack-bar and phonograph will be moved the space of one tooth, consequently the lines of indentations will be parallel and concentric to the shaft e excepting at the places when the tooth acts to move the rack-bar and phonograph outward or inward— In this case the spiral grooves are cut to correspond to the feed.

Fig 8.



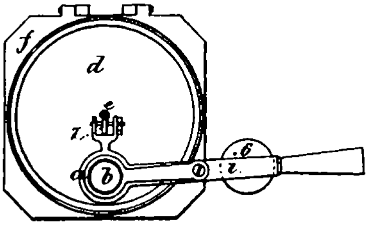
In fig. 8 a worm upon the shaft e acts upon a worm pinion to revolve the shaft e^5 and the worm at the other end of this shaft e^5 acts upon teeth around the base of the lever i on the stud 6: by this device the phonograph will be moved outward gradually and the line of indentations will be in a spiral corresponding to the continuous spiral groove in the plate d.

Fig. 9.



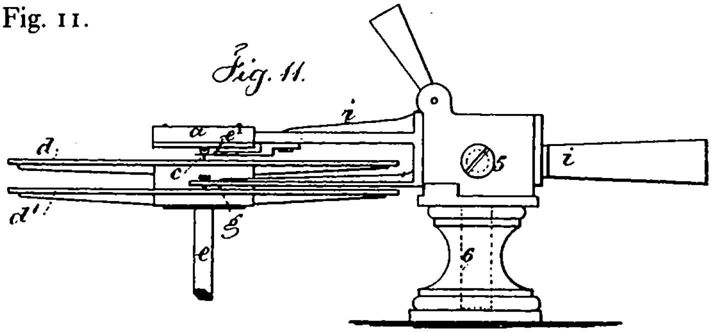
In fig. 9 the shaft e is made with a fusee at P^1 and one end of a swinging arm connected to the phonograph takes against the same; the spirals of the fusee gradually move outward the phonograph as the disk and shaft are revolved and the line of indentations will be spirally the same as that made by the spiral 3.

Fig. 10.



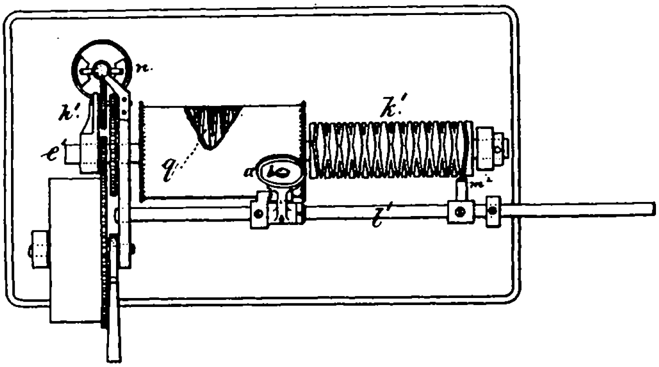
In fig 10 the shaft e is provided with a screw pinion meshing with teeth upon a cam-wheel 7; this gives the same movement to the phonograph as the spiral groove 3.

Fig. 11.



In fig. 11 the guide groove 3[7] for the arm and pin g is upon a disk d^1 upon the shaft e but the groove 3 occupies the same relative position upon the disk d^1 as the groove 4 upon the disk d so that the phonograph is moved outwardly by the groove of the disk d^1 swinging both the arms g and i upon the vertical pivot 6.

Fig. 12.[8]



Instead of the sheet of metal foil being upon the disk d it may be wrapped upon a cylinder q as in fig. 12. In this case the cylinder is upon a shaft e^1 revolved by the gearing at h^1

and upon said shaft there is a right and left hand screw at k^1 and there is a corresponding double spiral groove in the surface of the cylinder q.

The phonograph is secured to a sliding shaft l^1 and said shaft is moved endwise back and forth by the screw k^1 acting upon an arm m^2 that is secured to the said shaft l^1. As the phonograph is moved in one direction, the line of indentations is made spirally in the foil on the cylinder q and when the arm m^2 reaches the end of the screw it will be moved in the other direction by the reverse screw thread and the phonograph will make a second spiral line of indentations that will cross the first spiral line. This feature is especially available for a phonet where the surface of the cylinder q is formed of an electrotype or other copy of the phonogram, so that the words or sounds may be reproduced automatically and at intervals if desired—

Fig. 13.

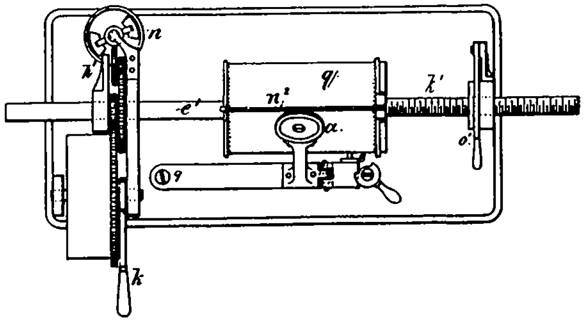
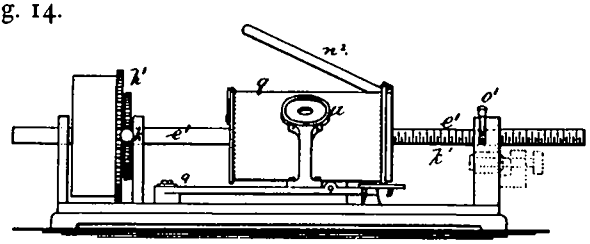


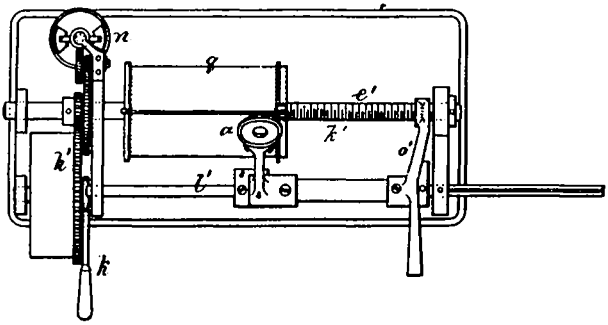
Fig. 14.



It is preferable to make use of a thin metal plate n^2 see figs. 13 and 14 pivoted at one end and fitting within a longitudinal groove in the surface of the cylinder q for securing the edges of the metal foil and holding it securely upon said cylinder— The top of the plate n^2 is flush with the surface of the cylinder and grooved to correspond with the grooves in the cylinder so as not to interfere with the indenting point A wire may replace this device such wire being secured by arms at each end of the cylinder and raised and lowered in and out of the groove by a cam or otherwise— I find that an interruption of one eighth of an inch space where there is no recording is not detected by the ear.

The apparatus shown in figs. 13 and 14 is similar to that shown in fig 12 except that the phonograph is stationary and the cylinder moves horizontally and the shaft e^1 is only provided with a screw thred in one direction, hence the cylinder will have to be moved back by hand to bring it to place if desired to reproduce the sounds from the phonogram, or to position the phonograph if a new sheet of foil is to be indented after the first one has been removed— This is readily accomplished by raising the arm o^1 and its tooth from the screw k^1 which leaves the shaft up and cylinder free to be moved back and forth.

Fig. 15.



In fig. 15 the phonograph is fitted to move horizontally instead of the cylinder q as in fig 12 but the shaft e^1 is provided with a screw thread in one direction only, hence the phonograph has to be positioned by hand after the arm o^1 has been raised from the screw k^1.

In figs. 12 and 15 the phonograph can swing upon the shaft l^1 to raise the indenting point from the cylinder q and allow for the removal or insertion of a sheet of foil, and there is a stop[9] at 8 for adjusting the position of the phonograph when brought down to indent the foil. In figs. 13 and 14 the phonograph is upon an arm pivoted at 9 so that it can be swung horizontally away from the cylinder q for the purpose aforesaid and the adjustable stop[10] 8 is also provided—

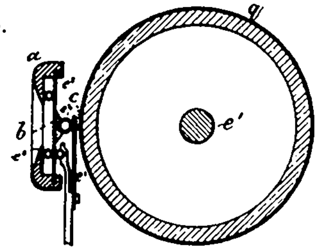
Thus far I have described the "phonograph" or instrument upon which the sound vibrations act, and which instrument acts to indent the sheet of foil and produce the "phonogram" or record of such sound vibrations; mechanism has also been described for presenting the sheet of foil to be indented by the phonograph. I will now describe how the sounds are reproduced from the phonogram—

If it is desired to reproduce the sounds from the phonogram in the same instrument in which the phonogram was produced, it is only necessary that the indenting point c be made to traverse the line of indentations in the phonogram and that a funnel shaped mouth piece, shown by dotted lines in fig. 1 be added to the phonograph, to aid in increasing the loudness and distinctness of the sound. The instrument in this form I term a "Phonet"—

In the instrument shown in figs. 1 2 6 7 8 9 10 11 13 14 and 15 the phonet requires to be positioned by hand as before explained in order that the point c may be placed at the beginning of the spiral line of indentations. As the point c passes from one indentation to the next either by the foil being moved beneath said point as in figs. 1 2 6 7 8 9 10 11 13 and 14 or by the point moving over the foil as in figs. 12 and 15 the diaphragm b receives a movement corresponding to the depth of the indentations, and corresponding also with the same movement it received from the sound vibrations when making those indentations, hence air waves will be produced by the movement of the diaphragm that will make sounds by passing through the mouth-piece of the phonet that will be exactly the same as the sounds that acted upon the diaphragm of the phonograph. The material upon which the record is made may be metal foil such as tin, iron copper, lead zinc cadmium, or a foil made of composition of metals, paper or other materials may be used, the same being coated with parafine or other hydro-carbons, waxes, gums, or lacs, and the sheet so prepared may itself be indented, or the material, say paper may be made to pass through a bath of hot parafine and thence between scrapers; thin metal foil is now placed on the material and the sheet passed through rollers which give it a beautiful smooth surface. The indentations can now be made in the foil and the parafine or similar material and the indenting point does not become clogged with the parafine in consequence of the intervening foil. If the copper-foil or tin-foil with copper surface is used, and a matrix of iron or steel made by electrotype deposit or otherwise upon the phonogram, such matrix may be hardened and used for impressing a sheet or roller of metal as hereafter mentioned, thereby the original phonogram can be reproduced indefinitely in metal that may be hardened and used for any reasonable length of time to utter the sentence or words or sounds phonetically—

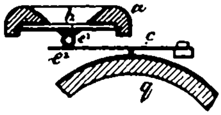
I will now briefly describe some modifications in the construction and operation of the Phonograph and Phonet.

Fig. 16.



In fig. 16 the indenting point c is upon a spring arm e^2 as in figs. 1 and 2 but there are short sections of rubber tube e^3 at each side of the diaphragm b to dampen the diaphragm and prevent false vibrations.

Fig. 17.



In fig. 17 the rubber of the diaphragm acts against the outer end of the arm e^2 to increase the leverage and lessen the depth of indentations in the foil and allow of the record being made in less yielding material than tin-foil.

Fig. 18.

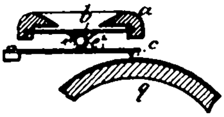


Fig. 18 shows a modification of the last mentioned device the pressure being applied to the arm e^2 between the indenting point and the support for the arm so as to increase the depth of indentations.

Fig. 19.

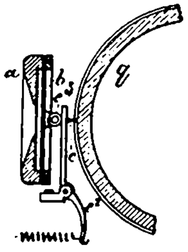


Fig. 19 shows the arm e^2 made as a lever with a spring

Fig. 20

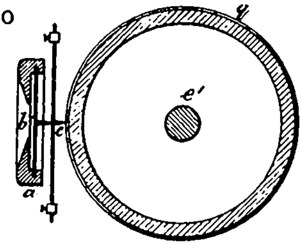


Fig. 20 shows the indenting point upon the center of a spring bar that is firmly held at each end; the bar is connected at its center to the diaphragm b by a string or otherwise.

Fig. 21.

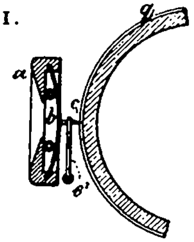


Fig. 21 represents the diaphragm b as of concave form instead of flat.

Fig. 22

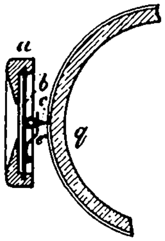


Fig. 22 shows the indenting point upon a spring secured to the diaphragm.

Fig. 23

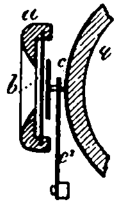


Fig. 23 shows a disk upon the spring e^2 of the indenting point; this disk is placed quite close to the diaphragm and is moved by the air as the diaphragm is vibrated, the disk being so close to the diaphragm that the two will vibrate together as air cannot pass between or escape as rapidly as the vibrations take place.

Fig. 24

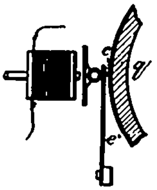


Fig. 24 shows the diaphragm vibrated by electro-magnetism In this case the diaphragm is to be of iron and the power of the electro-magnet will be varied by a rise and fall of electric current passing through the helix of the electro-magnet, this rise and fall of electro-tension is to be produced by the action of sound upon a diaphragm and connections in an electric circuit.

Fig. 25.

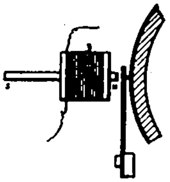


Fig. 25 shows the method of vibrating the indenting spring and point by the direct action of an electro-magnet without the use of a diaphragm, the electric tension in the helix being varied by sound vibrations upon a diaphragm.

Fig. 26.

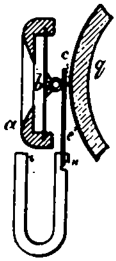


Fig. 26 shows the spring arm e^2 connected to one end of a permanent magnet so as to highly magnetize the reproducing point; the foil should be of iron;— when the point passes an indentation there will be less attraction than when passing no indentation; this will give good articulation free from the scraping noise of the point on the foil, for in this case it does not touch the foil but is worked by magnetic attraction.

Fig. 27.

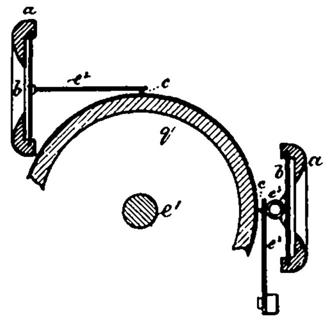


Fig 27 represents two instruments in connection with the cylinder q in this case the phonet and the phonograph are separate. The phonograph records in the usual manner but the phonet has its diaphragm set in motion by the rise and fall of the lever e^2. This reduces the scraping noise of the foil and acts by leverage and a slight tension to move the diaphragm as the phonogram is moved beneath the point c.

Fig. 28.

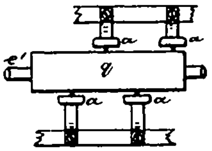


Fig. 28 shows an arrangement whereby four persons may speak simultaneously and have records made in separate parallel lines upon one cylinder and the phonogram will reproduce the sounds the same as though it contained the record of but one voice.

Fig. 29.

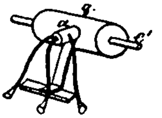
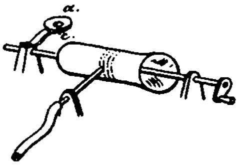


Fig. 29 shows a single phonograph adapted to receive the voices of three persons as in singing; the sounds made by the three voices are conveyed through flexible or other tubes to the diaphragm and will be recorded in a single line of indentations, but when reproduced by the phonet the sounds uttered will correspond to the three voices.

Fig. 30.



In fig. 30 the foil is sustained upon a hollow cylinder with a funnel shaped end. The record is made upon the foil in the usual manner by the phonograph excepting that holes are made entirely through the foil. A nozzle with a small opening is placed so that it will always be opposite the line of perforations as the cylinder is revolved. This nozzle is connected to a source of compressed air or other fluid, and every time a perforation comes opposite the nozzle, a puff of air passes into the cylinder and a sound is produced upon the principle of the siren— The nozzle may be placed on a spring to keep the end of the nozzle in contact with the line of perforations.

Fig. 31.

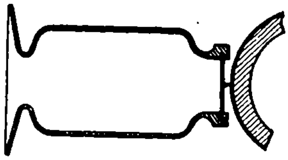


Fig. 31 shows the phonograph as made with a large chamber between the diaphragm and the mouth-piece this is especially useful in collecting sound when the person speaking or the sound to be recorded is made several feet from the instrument—

Fig. 32.

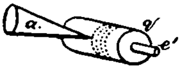


Fig. 32 shows a device whereby the indenting point may be dispensed with in the phonograph. The funnel forming the phonograph is made with a diaphragm at the larger end or mouthpiece, and a very small hole at the pointed end adjacent to the foil on the cylinder q; this foil should be very thin so that the indentations will be made by the direct action of the air waves as concentrated by the funnel without the interposition of the indenting point.—

Fig. 33.

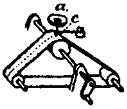


Fig. 33 shows a phonet in which the phonogram or sound record has been made upon an endless belt: this is a convenient arrangement for toys as the same may be made to imitate the bark of a dog or other noise made by an animal, and this belt may be of steel or other hard material that allows the same to be used for a long period of time.

Fig. 34.

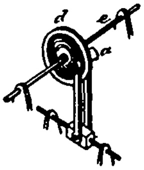


Fig. 34 is a perspective view showing a double phonet there being a spiral line of indentations on each side of the revolving disk d one phonet coming into action as the other finishes: in this case the spirals should be in opposite directions so that the disk continuing to revolve in the same direction, moves one phonet from the center outwards and then the other phonet is connected and moved back towards the center: this may be used as a toy.—

Fig. 35

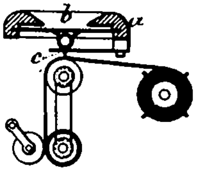


Fig. 35 represents a phonet in which the phonogram containing a sentence, speech, words, or other sound record is upon a belt or strip wound upon a reel; this belt is drawn along gradually and wound upon the second roller by any suitable mechanism, and as the phonogram is thus moved it actuates the phonet c b.

Fig. 36

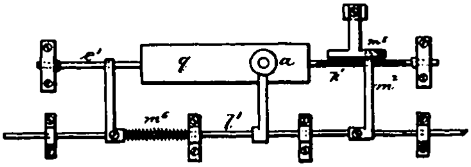


Fig. 36 shows a phonograph or phonet similar to that shown in fig. 12; the cylinder q is revolved but remains in one position and the phonograph or phonet is movable back and forth over the cylinder In this instance the arm m^2 is extended beyond the screw k^1 and passes beneath the inclined spring guide m^5 when the screw is carrying the arm and phonograph towards the right: as the arm m^2 passes from beneath the end of the guide m^5 it is no longer held to the screw and the arm m^2 and phonet are lifted by the guide m^2 as the spring m^6 draws the shaft, phonograph and arm along to the place of beginning, at which place the arm m^2 drops off the end of the inclined guide m^5 into the thread of the screw, and as this revolves it carries the arm along beneath the guide m^5 as before.

Fig. 37

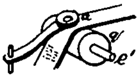


Fig. 37 represents the phonograph or phonet upon a pivoted arm so that it may swing across or at right angles to the line of movement of the indented material or phonogram. In this case the line of indentations may be lengthwise of the belt or across the same in the arc of a circle

Fig. 38

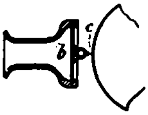


Fig. 38 shows a phonograph similar to that shown in fig. 31 except that the sound chamber is of a different shape

Fig. 39.

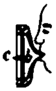


Fig. 39 shows a mouth-piece with an orifice of soft rubber to fit the mouth or the lips of the person speaking so that all sound waves will be confined to the chamber and diaphragm.

Fig. 40.

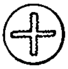


Fig 40 shows the mouth-piece of the phonograph made with cross slots with irregular edges.

Fig. 41.

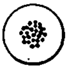


Fig 41 shows the mouth-piece as perforated with numerous holes.

Fig. 42

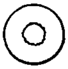


Fig. 42 shows but one opening in the mouth-piece: the edges of this are irregular— These irregular edges reinforce the hissing sounds and cause a more perfect phonogram[c] to be produced.—

Fig. 43.

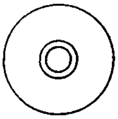
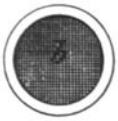


Fig. 43 represents a mouth piece of mica with a central opening protected at its edges by a wooden ring—

Fig. 44



In fig. 44 the diaphragm b is of wire gauze with a backing of paper connected to it by any suitable cement and there is a ring of stiff paper at the edges of the gauze disk to strengthen it.—

Fig. 45.

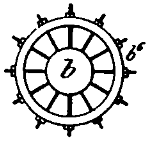


Fig. 45 represents a diaphragm b of parchment or similar material stretched tightly within the frame b^6 by cords and screws— The cords may be of different lengths and tension and respond to and reinforce certain sounds.

Fig. 46.

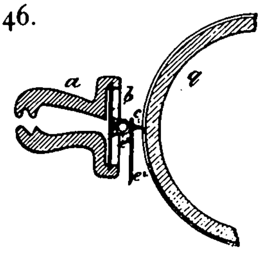


Fig. 46 shows a mouth-piece for the phonet made in imitation of the human mouth.

Fig. 47.

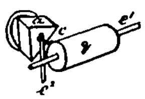


Fig. 47 represents the body portion of the phonograph or phonet made triangular and the diaphragm is of corresponding shape.

Fig. 48.

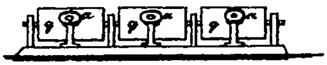


Fig. 48 represents three cylinders each provided with a phonograph or phonet; this is useful in recording and reproducing three part singing or music.

Fig. 49

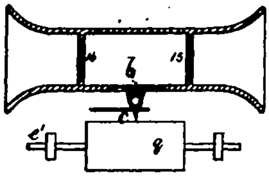


Fig. 49 represents a phonet made as a tube with flaring or trumpet shaped ends and with two diaphragms 15 16 placed cross-wise of the tube so as to form an air chamber— There is a third diaphragm b which is vibrated by the movement of the reproducing point c and said diaphragm gives motion to the air in the chamber and vibrates the diaphragms 15 16 which latter produce air waves and the sounds issuing from the two trumpet shaped ends will blend and increase the volume of sound.

Fig. 50.

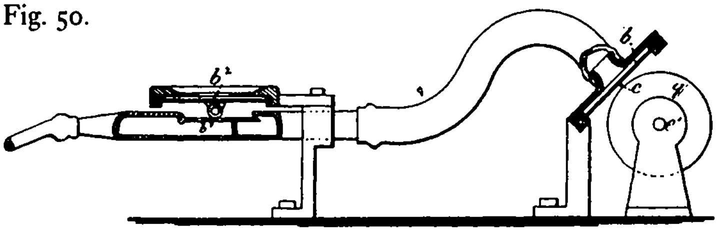


Fig. 50 represents a device whereby deep indentations are made in the metal foil— Two diaphragms are employed; the first:[11] b^2 is vibrated by the sound vibrations and controls a valve b^7 in a tube connected with a source of compressed air or other fluid; this valve b^7 allows more or less air to pass to the diaphragm b according to the vibration of the diaphragm b^2 hence the diaphragm b will vibrate in harmony with the diaphragm b^2 but it will be acted upon by greater force and consequently the indentations will be deeper in the foil than if the diaphragm b was acted upon simply by the sound vibrations of the voice.

Fig. 51.

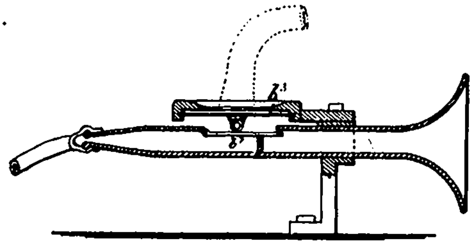
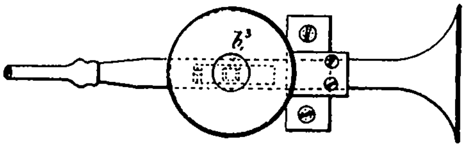


Fig. 52.



Figs 51 and 52 represent a device that may be used with a phonet to increase the loudness of the sounds reproduced. The sound vibrations from the phonet are conducted by a tube shown by dotted lines in fig. 51 to the diaphragm b³ that controls a valve b⁷ in a tube connected with a reservoir of air or other fluid under pressure, and the air as it escapes by the valves passes into the trumpet shaped end of the tube and produces sounds that are very loud and clear and are a reproduction of the sounds resulting from the use of one of the phonets before described.

This same apparatus may be used to reproduce with louder utterances a person's voice, the sound from the voice being used to vibrate the diaphragm b³ and thereby regulate the air waves escaping from the valve b⁷ into the trumpet.

Fig. 53

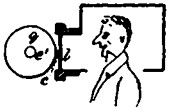


Fig. 53 shows the speaker's head within a box or case; in this instance nearly all the sound vibrations act upon the diaphragm.

Fig. 54.

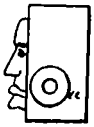
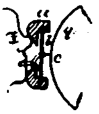


Fig. 55.



Figs. 54 and 55 illustrate how the movements of the lips in speaking may be recorded and reproduced. In this instance a lever applied to the diaphragm carries the indenting point c fig. 55 and the end of this lever is placed in the mouth of the speaker and the movement of the lips regulates the indentations in the foil. A similar apparatus shown in fig. 54 within a case is connected to the movable lips of a mask so that these lips open and close as in articulation at the same time that the sound vibrations are given by the phonogram to the phonet.

Fig. 56.

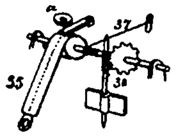
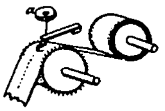


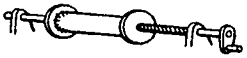
Fig. 56 represents a toy phonet in which the phonogram strip 35 is secured at one end to a cylinder upon which it is wound— By pulling upon the strip it is unwound and a rubber cord 37 is wound upon the shaft of the cylinder— When the hand is removed from the indented strip the rubber cord rotates the shaft and winds up the phonogram upon the cylinder and the sounds are reproduced in the phonet by the phonogram acting upon a point and diaphragm a. The movement of the shaft is regulated by the fan, worm and pinion 38.

Fig. 57



In fig 57 the cylinder for moving the phonogram-strip is shown as provided with pins that enter holes in the edges of the strip; this causes the strip to be fed along very regular.

Fig. 58.



In fig. 58 the cylinder with pins is shown as made with heads to act as guides for the strip

Fig. 59.

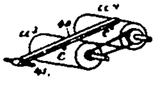
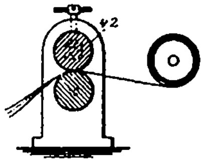


Fig. 59 shows a re-indenting device for amplifying or increasing the size of the indentations— There are two rollers one of which a^4 travels faster than the other a^3 and there is a lever 40 pivoted at 41 and provided with a point c for each cylinder. One point follows the indentations in the cylinder a^3 and the other rests upon a^4 and as this travels the fastest, the indentations made therein will be longer and also deeper by the point being at the outer end of the lever.

Fig. 60



In fig. 60 one roller 42 of the pair is made of hardened metal with the sound record in relief. This is obtained by electrotype or other process from an iron foil or other metal phonogram and this roller is used to indent strips or sheets of foil or rollers to produce copies that can be used with the phonet.

Fig. 61.

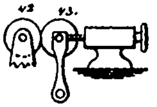
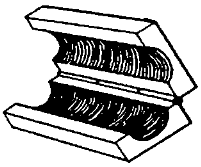


Fig. 61 represents a roller 42 of hardened metal with the record in relief and arranged so as to knurl or indent the phonogram in a roller 43 of soft metal that is to be pressed against the roller 42 by a screw or other suitable means.

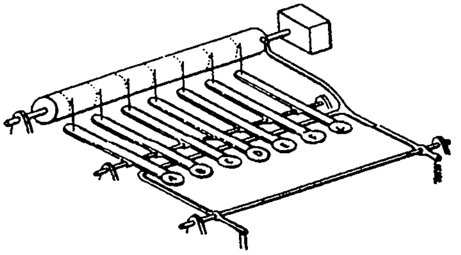
Fig. 62



The cylinder having a spiral groove in its surface may be made by placing the mould shown in fig 62 around a cylinder or shaft and filling the space between the cylinder and mold with plaster of paris or other suitable material— The mold is of metal with a screw or spiral rib projecting therefrom and it is made in two parts and hinged so that it can easily be removed when the plaster of paris is dry

For amusement or instruction the phonograph is capable of extended use.

Fig. 63



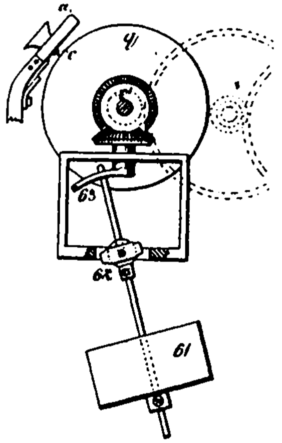
For instance, a revolving cylinder, see fig. 63 containing rows of indentations representing the letters of the alphabet and provided with keys containing corresponding letters, can be used in teaching the alphabet, and sentences, speeches, and other matter can be spoken by the phonet and repeated by the learner without the eyesight being called into use.

Clocks may be provided with phonogram cylinders or wheels to call off the hours, to give alarms &c.

The phonogram may be upon a strip, sheet, belt, or roller, and it can be of a dog's bark a rooster's crow, a bird's song, a horse's neigh, and these can be used in toy animals with a simple phonet for reproducing the sound.

In copying phonograms or making duplicates, an original phonogram may receive a deposit of copper, or iron in a plating bath, and if of iron may be carbonized to convert it into steel and hardened and then‹the same should be backed up with type metal and used for impressing strips or pieces of metal A bed of gutta percha or similar material may be used to sustain the sheet metal while being pressed; numerous copies of the original phonogram can thus be reproduced— A plaster cast can be used for producing a copy by pressure.

Fig. 64.



The governor to regulate the speed of the instrument may be made of a pendulum weight 61 see fig. 64^d hung at the lower end of a rod that is provided with a universal joint at 62 and the upper end of the rod is moved around by a crank 63 that is revolved by the train of gearing— As the speed increases the weight will describe a circle of larger diameter and thereby increase the resistance—

The universal joint may be displaced by a spring wire fig. 65 that allows of the movement—

Fig. 65.

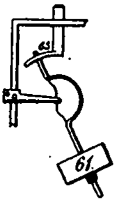
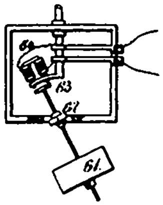
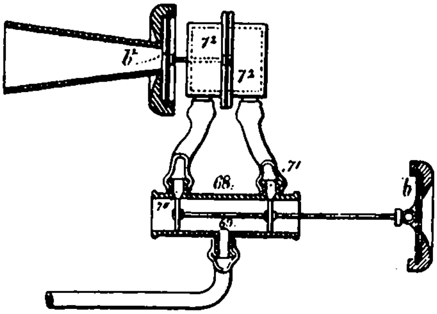


Fig. 66



A magnet 64 upon the crank-arm 63 fig. 66 may be used to revolve the pendulum by attracting an armature at the upper end of the pendulum rod and thereby avoid the friction resulting from the contact of the surfaces of the pendulum rod with the crank.

Fig. 67.



In fig 67 the diaphragm b is represented as connected to a pair of delicate piston valves within a tube 68 that has three parts, one 69 is connected to a reservoir of compressed air; the others 70 and 71 are connected to a chamber 72 at opposite sides of a diaphragm so as to vibrate the same in harmony with the diaphragm b but there will be greater amplitude given to the same by the pressure of the air and by a connection to the phonet diaphragm b^2 the sound produced will be greatly increased.

I shall probably[c] claim as my Invention,

~~First. A phonograph apparatus consisting in the combination with a diaphragm or body vibrated by sound, of a point and a surface upon which a record is made by indentations to produce a phonogram, substantially as specified.~~

~~Second. The combination with a phonogram of a phonet to reproduce the original sound, substantially as set forth.~~

~~Third. The method of reproducing speech and other sounds consisting in recording the same by the atmospheric vibrations and reproducing corresponding vibrations by the record or phonogram giving motion to a diaphragm or similar movable body.~~

1[f] The combination with the diaphragm and point of a flat receiving surface and means for revolving the receiving surface and causing the point to follow a volute or spiral line, substantially as represented in figs. 1 2 6 7 8 9 10 and 34

2 The combination with the phonograph or phonet of a propelling weight or spring and a governor to regulate the speed and ensure uniformity of movement substantially as set forth.

3 A revolving disk provided with a clamping frame to secure the foil or other material in combination with the swinging arm diaphragm and point substantially as specified.

4 The combination with a revolving grooved cylinder of a diaphragm and point and a screw or other mechanism for causing the point to correspond in position with the groove so as to indent the foil or other material wrapped around the cylinder substantially as set forth and shown in figs. 12 13 14 15 16 17 & 18.

5 In a phonograph or phonet, a spring introduced between the diaphragm and the point substantially as set forth and shown in figs. 16 17 18 19 22 and 26.

6 In a phonograph or phonet, a rubber spring or similar device to dampen the vibration of the diaphragm and prevent false vibrations as set forth and shown in figs. 16 and 21.

7—The combination with the diaphragm in a phonograph or phonet apparatus of a lever to modify the relative action of the diaphragm and point substantially as described and shown in figs. 17 18 27.

8 The combination with the diaphragm and point, of a permanent or electro-magnet, substantially as described and represented in figs. 24 25 26.

9 The method of recording and reproducing two or more sounds or speeches simultaneously substantially as described and as illustrated by figs. 28 29 and 48.

10 A phonet composed of a perforated sirene and a jet tube substantially as described and represented in fig. 30.

11 The mechanism for producing a phonogram and employing the same in a phonet substantially as described and illustrated in figs. 32 33 35 36 and 37.

12 The combination with the phonograph diaphragm and point of a sound chamber substantially as described and illustrated in figs. 31 38 39 and 53.

13 The diaphragm and mouth-pieces for a speaking phonograph substantially as described and as illustrated in figs. 41 42 43 44 45 and 46.

14 The combination with a diaphragm and its point of

two diaphragms for the purposes and substantially as shown in fig. 49.

15 In combination with a diaphragm and valve actuated by sound vibrations, a source of compressed fluid and a trumpet as in figs. 51 52 ~~on~~ or[c] a phonograph, as in fig. 50 substantially as set forth.

16 The combination of two diaphragms with a valve and a source of compressed fluid as represented in fig. 67 for increasing the volume of the voice or other sound as set forth.

17 The combination with two or more phonograms, of phonet keys for selecting letters or utterances as described and illustrated in fig. 63.

18 The means for duplicating or reproducing phonograms from an original phonogram substantially as set forth.

19 The combination with the phonograph or phonet of the revolving crank and pendulum governor substantially as described and shown in figs. 64 65 66.

20 The combination with the phonograph of a lever moved by the lips and of a lever and phonet to move the lips of a mask, substantially as described and illustrated by figs. 55 and 54.

21 The combination with a phonogram of a clock movement or toy and a phonet for reproducing sounds for clocks or toys substantially as set forth.

D (transcript), NjWOE, DF (*TAEM* 18:669). In an unknown hand. Periods used to demarcate figure references have not been reproduced. [a]Date from file wrapper. [b]All figures are on eight separate sheets. [c]Interlined above. [d]"see fig. 64" interlined above. [e]"shall probably" interlined above. [f]This and all subsequent claim numbers in a different hand.

1. Edison executed this caveat (Caveat 80) on this day and filed it at the Patent Office on 3 June (it is not in the existing National Archives file of Edison caveats; neither is Caveat 81 or 82). He had begun sketching designs for it on 5 March, and had drawn more on 28 March (NS-78-007, Lab. [*TAEM* 7:871–72]). At the same time, Lemuel Serrell was assembling materials for Edison's foreign phonograph patent applications. Serrell wrote Edison on 2 May that drawings and specifications for those applications awaited his approval for photolithographing (DF [*TAEM* 18:659]). Edison used those drawings as the basis for this caveat, which is why it includes material from his earlier phonograph caveat (Doc. 1227) and the drawings from his aerophone patent (U.S. Pat. 201,760), which had issued on 26 March. He did not include drawings from 30 April and later, even though some were labeled "Caveat 80" or "Caveat Phonograph" (Doc. 1310; NS-78-007, Lab. [*TAEM* 7:873]).

2. Edison's September patent application for the disk phonograph (Case 155) included figures 1–11 from this caveat (see Serrell to TAE, 8 July 1878, DF [*TAEM* 18:724]).

3. Located beneath "b" in figure 1, with an arrow pointing from "c" to the indenting point.

4. Located below and to the left of "c" in figure 1.

5. Located above "a" in figure 2.

6. Located to the left of "m1" in figure 1; to the left of "g" in figure 2.

7. Not shown in figure 11; see figure 2.

8. Edison's second September phonograph patent application (Case 154) covered much of the remaining material in this caveat along with the modifications to the clockwork cylinder phonograph of Doc. 1310. See Serrell to TAE, 8 July 1878, DF (*TAEM* 18:724).

9. Located to the right of "l1" in figure 15; similarly placed in figure 12 ("8" is illegibly small in both).

10. At right end of arm in figures 13 and 14.

11. Located at the top left; b7 is beneath b2.

-1342-

From George Scott

New York May 31, 1878[1]

T. A. Edison.

Your instruments are a success in the Brooklyn wire can you furnish me with 2 induction coils & transmitters alone to fit up a sett for merchants circuit I want to show you new design for combination box I am making.

Geo. B. Scott.

L (telegram), NjWOE, DF (*TAEM* 19:714). Another copy is in DF (*TAEM* 15:720).

1. This was the same day that Edison finally signed his agreement with Western Union regarding the payment for his telephone patents. The company ordered its shop, under the direction of George Phelps, to make "500 Edison Carbon Telephones with Morse Key, and sounder, and induction coil." Miller (*TAEM* 28:1105); American Speaking Telephone Minutes, 35.

-1343-

From Charles Stowell

Ansonia Conn. May 31st 1878

Dear Sir.

~~W~~A few weeks ago we met in Mr Ashley's room,[1] and you were giveing me some account of subdividing the Electric Light, and if my memory serves me you said as soon as you got some meaterial from Germany you wanted to come up to Ansonia to try it on some of our machines.[2] I told you to come and promised that Mr Wallace[3] would give you all the chance you could ask. When I got home then I told him ~~what~~ about our interview and he said as I knew he would that you could have all the chance to try anything you wanted, and he should be happy to see you here. So come along the sooner the better would be glad to see you here tomorrow.

You will remember that you said that they were all on the wrong trac~~t~~k using carbon. hope you will be as successful in this direction as you have in so many others. It will be a blessing to the world, to be able to subdivide. Fuller[4] makes a great noise about what he has got, but I do not think much of it. I will say that it worked well on two lights and Mr Wallace saw four, but a drawback to it is that if one ~~ch~~light chance to go out you have got to go to it and relight, besides there will be a question if he can use the Jablochkoff candle. When he was here I said as much to him and he replied that heis was entirely different from Jablochkoff, which I failed to see.

Wish you could say how soon we may look for you because we are want to see it divided even down to ten or twenty candle lights Yours Respt

Charles Stowell[5]

ALS, NjWOE, DF (*TAEM* 17:918).

1. As editor of the Western Union–sponsored *Journal of the Telegraph* James Ashley probably had rooms at the company's headquarters.

2. What "material from Germany" Edison was waiting for is unknown. He did not visit Ansonia until September. See Doc. 1423.

3. William Wallace (1825–1904), British-born wire manufacturer and inventor, established Wallace & Sons at Ansonia, Conn., with his father and brothers in 1848. With electrical inventor Moses Farmer he constructed dynamos based on Farmer's design, which were used in combination with Wallace's own carbon-arc lamp. He visited Edison at Menlo Park in 1877. See *TAEB* 3:413; *DAB,* s.v. "Wallace, William."

4. James Fuller, an electrician and electroplater, designed a system of arc lights sold by the Fuller Electrical Co. Edison had met him several years earlier in connection with demonstrations of Fuller's magnetoelectric generator in New York. Doc. 634; Hiram Crosby to TAE, 16 Feb. 1878, DF (*TAEM* 49:102).

5. Charles Stowell had been working as an electrician for Wallace & Sons since 1875. He had previously been an assistant to electrical inventor Moses Farmer in Boston (Stowell's testimony, *Sawyer & Man v. Edison (U.S.),* [*TAEM* 47:442–43]). On 8 June, Stowell wrote again to Edison indicating that "Your letter came in due time. well knew you were busy. never saw you when you were not. Still I felt anxious to see the light divided. All the world is astir now about light." He also asked if Edison had a situation for his brother Edward. A marginal note indicates that Edison sent his standard reply: "havent got anything at present moment am quite full here but will keep him in mind" (DF [*TAEM* 17:490]).

-1344-

To George Gouraud

[Menlo Park,] ⟨Sent 6:30 PM June 1st 78⟩[a]

Gouraud[b]

Take charge my Telephone in England.[1]

Edison

ALS (telegram), NjWOE, DF (*TAEM* 19:857). [a]Written in unknown hand. [b]Followed by several canceled illegible words.

[1] On 5 June, Gouraud cabled back "accepted." DF (*TAEM* 15:759).

-1345-

Agreement with James Adams

Menlo Park, June 1, 1878[a]

This memorandum of agreement entered into this first day of June eighteen hundred and seventy eight by and between Thomas A Edison of Menlo Park NJ and James Adams of Menlo Park NJ

witness. The said Edison‹has by the within contract of which it is a copy[1] been given a Royalty of Six thousand dollars per year for seventeen years from the date hereof payable semi monthly in payment for the said Edisons inventions in Telephones as herein set forth and whereas the said[b] Adams has given his time talents and attention in assisting the said Edison in bringing such inventions to practical uses therefore in consideration of such services by the said Adams to the said Edison the said Edison agrees to pay to the said Adams Six Hundred dollars in each and every year that the said Edison receives six thousand dollars from the first of June 1878 until the first of June 1895. If by any chance or process of law or otherwise the said Edison is not paid the said six thousand dollars then the said Adams shall receive nothing or if the sum be reduced the sum paid the said Adams shall be reduced in proportion This shall be binding upon my executors, assigns or legal representatives[2]

In witness whereof I have this day set my hand and seal

Witness Wm Carman Thomas A Edison

DS, NjWOE, DF (*TAEM* 19:716). Written by William Carman. [a]Place and date taken from document, form altered. [b]Obscured overwritten letters.

[1] This was probably originally attached to a copy of Edison's 31 May contract with Western Union regarding royalties for his telephone inventions; a similar agreement with Charles Batchelor, giving him $1,200 per year from Edison's royalties is attached to a copy of the Western Union agreement. Batchelor (*TAEM* 92:269–88).

[2] After Adams's death in 1879, Edison continued to pay royalties to Adams's wife Ellen. See *TAEM G-2-3*, "Adams, Ellen."

-1346-

To William Preece

[Menlo Park,] Ju[ne] 4 78[1,a]

Preece

I regard Hughes heat measurer & Direct Impact telephone as abuse confidence. I sent you & others Papers describing it also in Letter about trouble in expansion telephones if you do not set this thing right I shall with details

Edison

L (telegram), UkLIEE, WHP. Message form of Anglo-American Telegraph Co. Ltd. [a]Date from British Post Office Department handstamp.

1. This telegram as well as the one following to William Thomson (Doc. 1347) were published in the 4 June *New York Herald,* which contained an interview with Edison regarding his claim of priority for the use of the carbon principle in a heat measurer. "Edison's Phonograph and Thermopile," Cat. 1240, item 644, Batchelor (*TAEM* 94:221).

-1347-

To William Thomson

[Menlo Park,] Ju[ne] 4 78[1,a]

Sir Wm Thompson

Direct impact carbon telephones sent Preece two months ago also publications and letters describing its use as heat measurer great abuse confidence his part in Hughes matter I send you publications of proofs[2]

Edison

L (telegram), UkLIEE, WHP. Message form of Post Office Telegraphs. [a]Date from British Post Office Department handstamp.

1. Sir William Thomson initially thought this telegram was intended for Sir Henry Thompson because of the London address, the spelling of the last name, and the fact that the newspapers had recently reported on Sir Henry's microphone experiments. After getting it back, William Thomson enclosed it in a 12 June letter to Preece, commenting

> you will no doubt wish to let Edison know that you had no idea of doing him injustice. He does I think deserve the first place in respect to credit for the microphone on account of what you told us at Plymouth of what he had done, which involved the essentials and some of the details, of the affair, very clearly I think. I should think Hughes has worked out what he has done so well, quite independently. [WHP]

George Gouraud later sent Edison a copy of Thomson's letter (see Doc. 1385 n. 1).

2. It is not known what publications Edison sent, but they probably included the 1 June 1877 *Journal of the Telegraph* article on his pressure relay (Doc. 926) and Prescott 1878b.

-1348-

To the Editor of the New York Daily Tribune

Menlo Park, N.J., June 6, 1878[1a]

Sir:

Allow me to make a few observations upon an editorial article which appeared in yesterday's TRIBUNE[2] upon the recent claims advanced by Professor D. E. Hughes, of London, to the invention of the leading features of my carbon telephone, and of my microtasimeter or instrument for the measurement of minute degrees of heat.

You have attributed to Professor Hughes two improvements upon my methods of preparing the carbon buttons for the telephone, namely: in the metalization of the carbon by plunging it in mercury, and in the division of the carbon into several pieces. Your supposition that the latter process is not identical with my use of gas retort carbon is perfectly correct, but the subdivision of the carbon had been repeatedly tested by me in my experiments on the telephone, especially in a series conducted at the special request of President Orton shortly before his death, of which the illustrative drawings were seen at the time by several persons, and are still in my possession. The metalization of the carbon by plunging it in mercury is also a process perfectly familiar to me, having been employed in many of my telephone experiments of last year, and, though mercury is not specially named, it is clearly included in the expression "finely divided metals" which occurs in the memoranda I furnished Mr. Geo. B. Prescott for his forthcoming work on "The Speaking Telephone," as printed in *The Journal of the Telegraph* for the 16th of April Inst. Mr. Hughes seems to have been so impressed with this phrase that he employs it repeatedly, speaking of "mercury in a finely divided state," of "holding the mercury in a fine state of division," of "metal distributed—in a fine state of division," of "iron in a fine state of division;" again, of "the minute division of the iron," and lastly of "a platinum surface in a finely divided state."

The change of electrical resistance with enormous rapidity by plumbago under pressure was a discovery of my own, distinctly set forth in my application for a patent for an "improvement in speaking telegraphs," dated July 20, 1877, as published at the time in *The Philadelphia Press* and *The Scientific American* (July 28, 1877). This discovery evidently covers the principle claimed as his own by Professor Hughes. He says: "It is quite evident that these effects are due to a difference of pressure at the different points of contact"—which is precisely the principle of my carbon telephone, thus set forth months ago by Mr. Geo. B. Prescott in the above-mentioned volume: "By constant experimenting, however, Mr. Edison at length made the discovery that when properly prepared, carbon possessed the remarkable property of changing its resistance with pressure, and that the ratios of these changes, morever, corresponded exactly with the pressure."

You consider as the most striking difference between my telephone and the instrument of Professor Hughes, that in the latter the diaphragm is dispensed with. In his own words: "It will be seen, however, that in the experiments made by myself, the diaphragm has been altogether discarded, resting as it does upon the changes produced by molecular action, and that the variations in the strengths of the currents flowing are produced simply and solely by the direct effect of the sonorous vibrations."

The following extract from Mr. Prescott's book, as given in *The Journal of the Telegraph,* April 16, 1878, will show that the discarding of the diaphragm is my own invention:

> In the latest form of transmitter which Mr. Edison has introduced, the vibrating diaphragm is done away with altogether, it having been found that much better results are obtained when a rigid plate of metal is substituted in its place. With the old vibrating diaphragm the articulation produced in the receiver is more or less muffled, owing to slight changes which the vibrating disk occasions in the pressure, and which probably results from tardy dampening of the vibrations after having been once started. In the new arrangement, however, the articulation is so clear and exceedingly well rendered that a whisper even may readily be transmitted and understood. *The inflexible plate,* of course, merely serves, in consequence of its comparatively large area, to concentrate a considerable portion of the sonorous waves upon the small carbon disk or button; a much greater degree of pressure for any given effort on the part of the speaker is thus brought to bear on the disk *than could be obtained if only its small surface alone were used.*

The claim of Professor Hughes to the discovery, that a modification of his microphone can be used as a measure of minute degrees of heat is still more preposterous than the preceding. This is a discovery of mine, which was first announced in *The Washington Star* of the 19th of April last. A copy of that paper was sent by me to Mr. W. H. Preece, the co-adjutor of Professor Hughes in this pretended "invention," and I have positive evidence that it reached him before the presentation of the so-called "microphone" to the Royal Society, inasmuch as he has made an extract from it in his address of May before the London Society of Arts.

Mr. W. H. Preece, electrician to the London Post Office Department, was in this country in the early part of last year, and visited my laboratory. I freely showed him the experiments I was then making, including the principle of the carbon telephone and the variability of conducting power in many substances under pressure. I made him my agent for the presentation of this telephone, and subsequently of the phonograph, in England, and kept him informed, by copies of publications and by private letters, of my leading experiments, as he always manifested a great desire to be the means of presenting my discoveries to the British public.

I therefore regard the conduct of Mr. Preece in this matter as not merely a violation of my rights as an inventor, but as a gross infringement of the confidence obtained under the guise of friendship. Yours very truly,

THOMAS A. EDISON.

PD, *New York Daily Tribune*, 8 June 1878, 5. In Cat. 1240, item 665, Batchelor (*TAEM* 94:229). [a] Date not that of publication.

1. On 8 June, the day this letter was published, Edison and Charles Batchelor compiled a list of leading European scientific and technological figures to whom they then sent copies. Cat. 1308:282, Batchelor (*TAEM* 90:786).

2. A copy of the editorial, titled "Telephone and Microphone," is in Cat. 1240, item 656, Batchelor (*TAEM* 94:225).

-1349-

From George Gouraud

London 6 June 1878.[a]

My Dear Sir,

I confirm your cable and my reply as per enclosed.[1]

I received also this morning, by accident, a cable from you to Bailey requesting that gentleman to call upon me here— I however put the same in train for delivery to Bailey—whose address is at Morley's Hotel— I do not yet know the nature of the business in question—[2]

I await your advices by mail confirming by Power of Attorney the placing of telephones in my hands—[3] The following extract from a further letter from Preece will interest you:

"Edisons transmitter is a good sound patent but the receiver is a clear infringement of Bell's British patent. Edison does not patent it but uses it—

"But there is a new telephone coming out which is quite independent of Bell's or Edison's and is going to be sold for half a guinea— However, I am sick of telephones, and wish that they were all at the bottom of the Atlantic—"

I am on the track of the half guinea telephone and will let you know what it is—[4] One thing is evident in telephones— We are to get no immediate benefit from the post office or in connection therewith—but I have no doubt of organizing a good strong Company upon the basis of their protecting the patents and furnishing working capital—we having a share—possibly half the net proceeds— I am inclined to think that this would be the best nucleus of organization at least—and will submit your plans in a few days— Several very strong parties have signified their desire to cooperate—

Microphone— I learn incidentally, though [—][b] confidentially, that you have cabled to the publishers of the paper announcing Prof. Hughes's invention of this— Whereupon I have notified Nottage of your claims and asked him if he would like to negotiate for an interest in it in England— Send me without delay all you have to bear upon this question— If you have good grounds for your claims, we can easily hold the monopoly—as nobody would be likely to feel that he could make enough out of it to justify his contesting in the Courts the use of it—

Puscas— I find my correspondence with this gentleman most unsatisfactory— Indeed it can hardly be called correspondence—as he does not answer my letters half the time— He has only gone so far as to say as to he would like to sell a part or his entire interest in the phonograph in Great Britain— This does not look much like looking after your reserved interest— I trust you will act promptly in the matter of my recent suggestions in this connection and put me in a proper position toward Nottage— Repeat my request that[c] you send[d] me a copy of your contract with London Stereoscopic Coy. without delay—so that I may see whether you are not legally entitled to a share in receipts from exhibitions of phonograph— They promise, if properly handled, to be a source of large revenue— A nephew of mine who is now in Paris writes me that the exhibition receipts in Paris amount to fr. 600 or fr. 700 per diem— What I want Nottage to do, is to organize exhibition lectures all over the Country—but I cannot get him to move in this— He even does not avail himself of the services of two gentlemen who offered to do the business on a share of the receipts—taking all the risks themselves— This sort of thing should be encouraged instead of ignored, as it is at present, by Nottage—

Electric pen— Let me know what your own interests are in this article [of?][b] America, and precisely what your relations are with Mr Beetle—who gives me to understand that he has the control of the question on this side and am now in correspondence with him regarding assistance to him on the Continent— If you are interested in the European pats. send me at once half a dozen specimens pens[c] complete, including your new press, if you have it finished—and I will forward them to the very best people amongst my good acquaintances in as many of the principal towns in Europe—and I have no doubt that I can materially help Mr. Beetle or whoever may have the thing in hand, by this means— Very Truly Yours

G. E. Gouraud

LS, NjWOE, DF (*TAEM* 15:756). Letterhead of Mercantile Trust Company. [a]"London" and "18" preprinted. [b]Illegible. [c]Interlined above by Gouraud. [d]Obscured overwritten letters.

1. See Doc. 1344.

2. On 3 June, Bailey had cabled Edison about joining Edison's British telephone interests with those of Elisha Gray: "Your combination with Gray secures Substantial monopoly England await letter before writing Preece." According to his letter of 8 June, Edison had replied "call on Gouraud." Bailey also stated that he then sent Edison a cable asking if he was "committed to Gouraud or were free to negotiate personally" to which Edison replied, "Gouraud has full power." As a result, Bailey and Franklin Pope arranged an interview with Gouraud for the following week, but hoped in the meantime that Edison would name his "*lowest* selling price for your telephone patent, in case that form of the business should come up." Bailey advised a modest price because

> the telephone field is a good deal cut up, and any patent will be attended with a good deal of litigation if the attempt is to be seriously made to enforce it. The time for fancy prices has gone by, and I hope that you will take these suggestions as fairly representing the situation, and not as made for the purpose of "beating you down." The situation is much muddled, and no one is going to pay a large price for any of the patents.

Gouraud wrote Edison on 25 June that Bailey had made an offer to combine the Edison and Gray interests. DF (*TAEM* 15:847; 19:857, 861).

3. See Doc. 1365.

4. Nothing is known of this instrument. A guinea was 5% more than one pound sterling, or 21 shillings; hence the amount mentioned was roughly equivalent to $2.50. See Doc. 1196 n. 5.

-1350-

Charles Batchelor to James Adams

[Menlo Park,] June 6th 1878[a]

Dear Jim,

I had not time to giv[e][b] you much in my last so put [it][b] strong. This is the damnedst steal in the country and Pree[ce][b] knew it all the time, dont let them get anything out of y[ou][b] From your letter you dont thi[nk][b] (or seem not to) that it is a st[eal][b] You must know that the microphone is only the telep[hone][b] with different adjustment o[ur][b] telephone has passed throug[h][b] the microphone stage and nobody knows or ought to better than you of that.

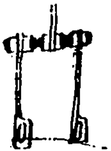
Refresh your memory well now and remember you now hav[e][b] a chance to distinguish yourself, defend it well and denounce Hughe's arrangement as an imposition.[1] We intend to go for them bad. I will keep you supplied with the papers and we are collecting our proofs in print and shall forward immediately Let me see if I cannot refresh your memory:—

—Do you remember that Edison took a sheet of plumbago paper while you were with him and laid it on top of the bindposts of Rheostat and you could hear your own singing?[2]

Dont you remember our using our using carbon, plumbago, etc on discs of card, silk, and other things that is the microphone when not adjusted up enough for clear talking. We have used one of these discs on each side of our button almost ever since you went away and here you can stand 100 feet away from the transmitter and talk to it and in my house I can get it perfectly even with 1000 ohms resistance. I have heard the little music box over 1000 ohms resistance when it was played 10 feet away from the transmitter I being at my own house[3] that is a true microphone but Hughes is nothing but bad connection and how ridiculous to think you can talk directly to the material itself without anything to shield it from moisture etc. Hughes says in his article that "It will be seen however in 'my' experiments the diaphragm has been discarded resting as it does on changes produced by molecular action and that the variations in the strengths of the currents flowing are produced simply and solely by the direct effect of the sonorous vibrations.

Now Jim I dont know whether you saw it or not but Edison gave an article to Prescotts book some time ago and it was published in the Journal of telegraph Apl 16 1878 This article says [ ][4c] Dont you know or see from this that our plate is not a diaphragm but only a collector and that the sonorous vibrations make the change by direct impact?

Do you remember the springs you made of steel with cups on end to hold plumbago like this:[5]



I have them all here now— As for the heat measuring arrangement that is ours and we can prove that Preece did not think of that till after he had received a paper from us called the Washington star and from which he quoted when delivering his lecture on the Phonograph before the society of Arts.[6] Dont you remember Prof Langley coming here and left Edison a small thermopile and Edison then promised to give Langley a heat measurer the principal of which was his carbon button some six months ago.[7] Oh it is the worst case of steal I ever saw. We have got magnificent proofs and records on it and we will make Preece so damned sick he will wish he had never been born. We will spend $5000 if necessary to expose it even if we lose our telephone there. Scientific American,[8] Dr Barker[9] and[d] many others see the 'steal' and are going for him 'red hot.' Keep me posted as to where you are and I will send everything. If you had not have got ofut of the hospital I was going to pack Ellen off to look after you.

Look in Scientific Amn and you will see Edison mentions finely divided metals.[10]

Read up everything on the[e] subject and when you think you can talk intelligently on anything go for [them][c] like the devil. Hope you are better again. Take good care of yourself whilst in Paris and [recover?][c] Dont [ ][f] first consulting us for we may have something for you to do in England yet again.

And now Jim let me tell you again that you have a first rate chance to distinguish yourself on this, tell them what you think even if you get your arse kicked for it, we have the proofs and they will have to take a back seat

Ellen is well and spend a great deal of time with us she worries a little but you ought to write her saying telephone is all right

Keep us posted From yours as ever

Chas [Batchelor][g]

ALS (letterpress copy), NjWOE, Batchelor, Cat. 1238:276 (*TAEM* 93:197). [a]Date written in by Batchelor. [b]Copy ran off edge of page. [c]Several blank lines follow. [d]Repeated at end of one page and beginning of next. [e]Faint copy. [f]Faint and missing copy. [g]Copy ran off bottom of page.

1. Adams replied from Paris on 19 June that he "did not feel like going for Preece direct" while testing Edison's telephone with him in London. After finishing the tests, however, he "talked it up to Preece and everyone around him from the letter A. to Z. now I shall Publish what I know about Microphone in the French & English Press." DF (*TAEM* 15:806).

2. A drawing of 21 June (labeled "Microphone") may be related to this idea (Doc. 1362).

3. In a notebook entry of this date, Batchelor wrote:

> Edison and myself with Proff Barker and Mr Robinson tried some experiments with regard to how far off sounds could be made that would so affect the plate on our transmitter as to send over 100 miles Proff Barker was at my house with me Edison stood 100 feet away and talked in his ordinary voice and we got it distinctly. The music box was played (15) fifteen feet away and heard distinctly. Our carbon button was pressed four times very delicate and had a silk disc on each side coated with plumbago. [Cat. 1317:61, Batchelor (*TAEM* 90:687)]

4. It appears that Batchelor pasted excerpts from the article on his letter, as the Letterpress copy has blank space here. The article ("Edison's Carbon Telephone") is in Cat. 1031:109, Batchelor (*TAEM* 27:800).

5. See Doc. 880.

6. Edison had announced his heat measurer in the 19 April issue of the *Washington Evening Star* (see Doc. 1289 n. 3). Preece's formal paper, published in the 10 May issue of the *Journal of the Society of Arts* (Preece 1878b), contains no mention of the heat measurer, though he did mention Edison's aerophone and Hughes's microphone. There are missing letters from Preece to Edison and it is possible that he mentioned in one of these about reading from the *Star* article. It is also possible that an account of the meeting at which Preece demonstrated the phonograph appeared in another journal and mentioned his discussion of the heat measurer.

7. See Doc. 1367. Samuel Langley was director of the Allegheny Observatory and professor of astronomy at the Western University of Pennsylvania (which became the University of Pittsburgh). *DSB*, s.v. "Langley, Samuel Pierpont."

8. The 8 June *Scientific American Supplement* (5:2024–25), which would have been published by the time of Batchelor's letter, contains a reprint of Prescott 1878b preceding a reprint of Hughes's 1878. In the 8 June regular issue, the journal's editor compared Hughes's claims and experimental results with those obtained by Edison during his carbon telephone research and concluded: "It is of course impossible, without much more evidence than is before us relative to Professor Hughes' experiments, to reach any certain judgment as between him and Mr. Edison, but a *prima facie* case in favor of the priority of the latter seems to us pretty clearly made out." "Electricity," "Edison's Carbon Telephone," "On the Action of Sonorous Vibrations in Varying the Force

of an Electric Current," "The Carbon Telephone," Cat. 1240, items 634–37, Batchelor (*TAEM* 94:217–20).

9. For George Barker's defense of Edison's claims see Barker 1878 (Cat. 1240, item 758, Batchelor [*TAEM* 94:271]).

10. Batchelor is referring to the *Scientific American Supplement* reprint of Prescott 1878b (see note 8).

-1351-

Charles Batchelor to George Bliss

[Menlo Park,] June 7th [187]8

Geo H. Bliss. Esq.

In manufacturing the telephones it will be necessary to observe the following instructions:—[1]

1 Case must be japanned, and the words "EDISON'S CARBON TELEPHONE" cast on top round the base of mouthpiece where it can be plainly seen

2 The glass in the brass tube on diaphragm must be ground perfectly flat and must be put in, in the following manner:— After the brass tube is soldered on, all the solder must be got out of the inside of the hole, and when glass is put in be careful that it goes to the bottom and fits in the brass tight, after this is done drop a single drop of pure shellac softened by heat into the bottom of the brass to hold it. Dont [use][a] ordinary sealing wax for this purpose as the telephone with continual talking gets a little warm and it might soften it

3. The screws that hold the telephone together must be nickelplated and polished at both ends

4 In boring out the rubber that holds the carbon button be careful that the guage does not go tight into it, and also that the shape of the hole does not alter when you take the rubber out of the chuck; as our carbons are so delicate that they will not allow of crowding in, but must drop in perfectly free, ~~but~~ without shake.

5 The two platina surfaces must be perfectly flat

6 The diaphragm must have a coat of japan or varnish to protect it from moisture from the mouth.

By attending to the ~~following~~ above instructions we shall have no difficulty in adjusting the telephones when they come here for their carbon buttons Very respty yours

Chas Batchelor Asst.

ALS (letterpress copy), NjWOE, Cat. 1238:280, Batchelor (*TAEM* 93:201). [a]Faint copy.

[1] These instructions were intended for the Western Electric Manufacturing Co., which had just been given an order by Gold and Stock Telegraph Co. to make "six Edison carbon telephones with Morse key

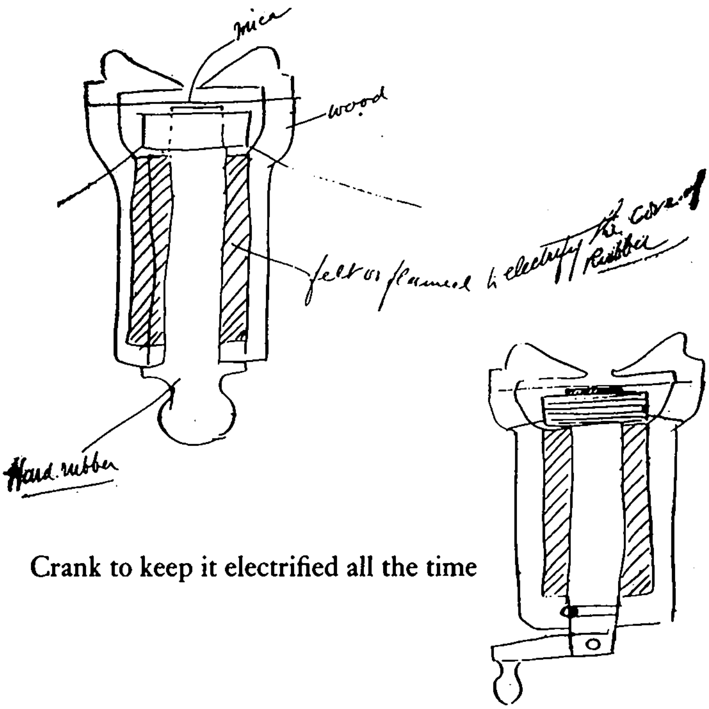
and sounder and induction coil, the same to be delivered to and tested by Mr Edison." If these trial instruments proved satisfactory, Gold and Stock planned to order 250 additional telephones. Western Electric apparently made at least one trial instrument by 31 May and sent additional instruments to Gold and Stock during the last two weeks of June. By the beginning of August, Western Electric had made 350 transmitters for Gold and Stock. G&S Executive, 186; George Scott, "Memo of dates, showing when the Edison Carbon Transmitter was first used," Box 1093, NjWAT; Enos Barton to TAE, 8 Aug. 1878, DF (*TAEM* 19:740).

-1352-

Technical Note: Telephony

[Menlo Park,] June 10th 1878

Speaking telephone receiver[1]



Crank to keep it electrified all the time

J Kruesi Chas Batchelor

X, NjWOE, Lab., Vol. 14:111 (*TAEM* 4:259). Written by Charles Batchelor.

1. This drawing and the one that follows are designs for telephone receivers worked by electrostatic charge rather than by electromagnetism. A measured drawing of this design was made by John Kruesi on 11 June and the instrument was available for experiments a few days later. This design was apparently used in connection with the experimental program laid out in Doc. 1215, which commenced on 2 June. On 15 June, Batchelor indicated that they wanted to try it as a transmit-

ter using diaphragms of different substances. On 17 June it failed to work as either a receiver or transmitter. The following day, Batchelor tried some additional experiments with different materials—copper, steel, iron, and lead—in place of the rubber core. Though he obtained no results with either mica or copper foil diaphragms, Batchelor found that he got some results when using it as a receiver with an iron diaphragm. He then found that it worked "without any core just with a diaphragm." There are no further records of experiments with this design. Vol. 14:113, 120, 122, 125, Lab. (*TAEM* 4:261, 275, 277, 280).

-1353-

From Gardiner Hubbard

Washington, D.C. June 12 1878[a]

Dear Mr. Edison

I understand that at Mr. Prescott's request, you wrote a chapter on your Telephone for the book recently issued by him on the Telephone & Phonograph.

Mr. Painter informs me that in this article you repeated the fact which you have so freely expressed to me and others—that you regarded Mr. Bell as the original inventor of the Telephone—& that this sentence was eliminated by Mr. Prescott.[1]

I will be much obliged if you will allow me to publish this fact under my own signiture.

You have made so many inventions that this acknowledgement of the originality of Mr. Bell's invention ~~invention~~ of the Telephone adds luster to your name.

I trust you will go on making still further inventions & receive the reward of renown and pecuniary profit you richly deserve I am Truly your friend

Gardiner G. Hubbard

⟨When I see you again I want to have a talk with you on the subject Bell in conjunction with P[reece] has done me a very great injury nevertheless I will do what you desire⟩[2b]

ALS, NjWOE, DF (*TAEM* 15:783). Letterhead of Bell Telephone Co. [a]"Washington, D.C." and "187" preprinted. [b]Written by Stockton Griffin.

1. During his testimony in the Telephone Interferences, Edison stated, "I did most emphatically give Mr. Bell the credit of the discovery of the transmission of articulated speech by that principle [of induction currents] in this article, but it was scratched out by some person unknown to me after it had been delivered to Mr. Prescott, and it was not published" (TI 1:115 [*TAEM* 11:78]). The statement in question concerns the first full paragraph on page 22 of Prescott 1878c which was substantially changed to remove all references to Bell. The draft version reads

> It will be noticed that the receiving instrument which I use contains the diaphragm magnet & chamber of the magneto telephone of Prof Bell, and I believe myself to be the first to use it In Acoustic telegraphs but I distinctly disclaim having discovered that conversation could be carried on between one receiver and the other upon the magneto principle by causing the voice to vibrate the diaphragm. This I concede to Prof Bell as it never occurred to me and I was as much astonished as anyone when I heard in April 1876 of his discovery of the fact, and the practical demonstration of it in June 1876 at the Centennial Exposition Although I believe Mr Bell used parchment diaphragms with small iron armatures up to 1877. [DF (*TAEM* 17:184–85)]

2. On 17 June, Stockton Griffin composed a letter based on these notes. TAE to Hubbard, Box 1198, NjWAT.

-1354-

From Uriah Painter

W[ashington, D.C.]— 6-12-78

My Dr E

I think you are in error if you think Bell would himself have anything to do with any attempt to filch from you one iota of your honors— I know he told Mr H. ~~that~~ before he left for Europe that there was only one man in the world that he feared would be able to make another Telephone & that was Edison— I know his letters home have been full of admiration of your genius in the Phonograph & full of anticipations of a personal acquaintance on his return this summer— He had to sell a large share of his Telephone Patents here to get money to take out Patents in Europe & to get funds[a] go over himself & introduce them— He lost the control of his Telephone in England by being overreached & frozen out by these identical men who are now trying to steal yours— All these facts I have gathered from time to time & they are not consistent with his aiding to strip you of your honor & your property— I met Mr Bell here several times in 77[b] & was very much impressed with his candor his simplicity & his conscientiousness— I hope you will go slow in making up any adverse opinion on him— I cant see how Hughes & Preece dare[c] to put in any such claim! They are men of intelligence & must know a lie cannot live! I think the papers must have got it wrong somehow— Dont let any new thing out till I get over next week— Keep quiet, till we see the whites of their eye!

P.S— Since writing the above Mr Hubbard stopped in my office & I read him your letter! He says "Tell Edison that ~~as~~ Preece has served him precisely as he served Mr Bell, & Mr Bell feels very hard against Mr Preece & Mr Hughes— I rather guess that Preece is the Prescott of England— "A sucker"! & "a fraud"—

I will be over next week & have full talk with you over all these things! Congress adjourns on 17th & then I'll be foot loose for a while—

We find Cheever has no idea of the value of money & wont do for a business manager & will make other arrangements.

I'll get you some data for your pamphlet on Preece as to his trying to & coming[1] the Prescott over Bell

I see in Prescotts book[2] he treats of the "Quadruplex as used by WU"—and evidently trys to leave the impression that it is his! combination!!

Suppose you put another chapter in, & give him a lively turn!

Do you want any more money before I come over about 18th? We have about $1000. more ready for you [~~most~~?][d] in Phono'.

Phono' show keeps up pretty well here— Barker & Bently ruined Phila' as a "pay town"—[3]

Do you want any more Stars Those cost 35 cts a piece— I may squeeze out some more if you do— Its [ducer?][d] how soon a whole edition of a paper disapears![4]

You ought to close your doors at Menlo to all strangers, & only show your hand when you are ready for the market & then its too late for thieves to get your things— Yrs

U H Painter

Do you want any more Photographs? UHP

ALS, NjWOE, DF (*TAEM* 15:785). [a]"get funds" interlined above. [b]"in 77" written in left margin. [c]Underlined twice. [d]Illegible.

[1] Acting the part of. Farmer and Henley 1970, s.v. "come."

[2] Prescott 1878c, chap. 11.

[3] Painter wrote Edison on 19 June that George Barker "is a fearful man after money & never says divide to you, or gives you the credit you are entitled to." He complained that Barker's and Henry Bentley's lectures had "ruined our show biz in Phila'! There was a fearful amount of Barker & Bentley on the Phono' but very little of Edison!!" DF (*TAEM* 15:804).

[4] In an undated letter Painter noted that he had sent Edison "two hundred stars with yesterdays article in it is impossible to get any number of stars of nineteenth April. I cleaned out the star office and every other place for you in April I will advertise for copies and offer 8 cts for them and may get a few that way." Edison answered "We require 4 or 5 stars of nineteenth of April." That issue contained Edison's claim that he had used his carbon principle to measure heat. This was one of the main points of his dispute with Preece and Hughes. In an

undated telegram, Edison thanked Painter for sending him copies of the 5 June issue of the *Washington Star* and indicated that the copies he had sent of the 26 April issue of the *Washington Weekly Star* would "suffice." This issue probably contained a reprint from the 19 April issue of the daily paper and Edison sent copies to several people. DF (*TAEM* 17:129–30); Cat. 1308:282, Batchelor (*TAEM* 92:786).

-1355-

Charles Batchelor to Partrick & Carter

[Menlo Park,] June 12 1878

Messrs Partrick & Carter

Telephone—[1a]

1 Box finished like the Phelps instruments[2b]

2 Transmitter Japanned and screws blue[d?][c] an lacquered[b]

3 Transmitter top to have 'EDISON'S CARBON TELEPHONE' in raised letters of cast iron round base of mouthpiece[b]

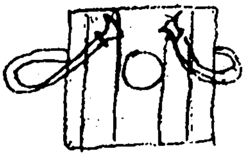
4 Magnet to be made 1½ wide by ½ inch thick and when magnetised should lift six (6) pounds[b]

5 Spools to be 50 ohms each[b]

6 Ear pieces of rubber with flexible tube long enough to reach to the ear, the tube to be thin but covered with silk (red or green)[3b]

The ear pieces must have a hook to hook on to on the corner piece

7 [ ][d]



8 Make ear pieces I think suitable ones can be bought[e] must come to the ears well and not be too short[b]

9 Larger size bindpost[b]

10 Coil must be wound with four layers of No 17[f] seventeen silk covered wire for primary and 9[f] nine layers of No 32[f] thirty two silk covered wire with a sheet of paraffined paper between each layer

Resistance of primary	.34 ohm
Resistance of secondary	150 ohm[4]

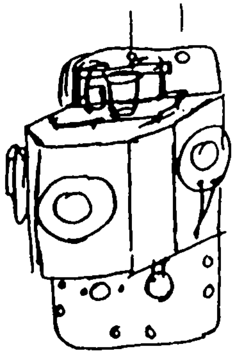
11

Chas Batchelor for Thos A Edison

ALS (letterpress copy), NjWOE, Lbk. 3:267 (*TAEM* 28:716). [a]Underlined twice. [b]Followed by centered horizontal line. [c]Faint copy. [d]Several lines of copy illegible. [e]"I think . . . bought" interlined above. [f]Circled.

1. This same day, Edison wrote to George Walker, vice president of Gold and Stock Telegraph Co., that he had "given Pa[r]trick & Carter of Phila an order for 25 Telephones for my own use— If they prove satisfactory and you wish to have them I will turn them over to you." These combination instruments consisted of Edison's carbon transmitter and his receiver, a slightly modified version of Bell's design. Edison apparently wanted to use these combination instruments in foreign countries, where he did not have rights to the Phelps magneto receiver. He may also have wished to impress Gold and Stock with his combination device and ultimately persuade Western Union to adopt it, rather than just his transmitter, in the United States. He wrote Enos Barton of Western Electric on June 21 that the telephones "will be 'bang up' and I think Mr Walker will order a hundred more." Lbk. 3:266, 294 (*TAEM* 28:715, 740).

Edison had started making arrangments with Partrick & Carter in mid-May. Work could not begin, however, until Edison provided a model telephone, which he had ready on 10 June. On 17 June he told the shop, "Please do your best on the twenty five telephones, get them up in good shape and good appearance I shall probably order as many more when these are completed." The instruments were not finished until 19 July, when Stockton Griffin telegraphed Edison in Wyoming that Partrick & Carter had shipped them. Partrick & Carter to TAE, 13 May 1878; TAE to Partrick & Carter, 10 June 1878; Griffin to Partrick & Carter, 19 July 1878; all DF (*TAEM* 19:704, 719; 15:972); TAE to Partrick & Carter, 17 June 1878, Lbk. 3:279 (*TAEM* 28:727).



Charles Batchelor's sketch of 27 May 1878.

2. Batchelor probably meant a box similar to one he had drawn on 27 May. He made that sketch for John Kruesi, whom he told: "I want to make a telephone like Phelps arrangement, that is a bracket box like this." He asked Kruesi to have a workman begin making such a box because "Edison wants this bad but I do not want to bother you with it until I get the shape of box I want." NS-Undated-006, Lab. (*TAEM* 8:510).

3. Partrick & Carter wrote on 20 June that they had been waiting seven days for the rubber tubing but "we found that it does not come ready made of the suitable size" and had not yet arrived. Edison evidently suggested instead that they substitute a type of tube commonly used in theaters. The shop replied on 24 June that although this was readily available it was too large and inflexible. They still hoped to find the specified material, but suggested they might use "the rubber tubing same as you have on your Telephone [see headnote, *TAEB* 3:590], we have can have it covered with silk or worsted, the latter more durable & less expensive and looks equally as well." Partrick & Carter to TAE, 20 and 24 June 1878, DF (*TAEM* 19:723, 726).

4. This was the standard coil design Edison chose after a series of tests in March (see Doc. 1241 n. 4). On 19 June, Partrick & Carter asked Batchelor to clarify the design of the coil; his marginal notes on the back of that letter indicate his reply: "You are right it is a simple Induction coil of 150 ohms 4 layers of No 17—9 layers of 32." Miller (*TAEM* 28:1122–23).

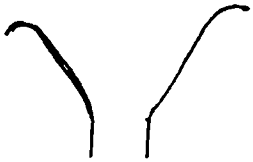
-1356-

[Menlo Park,] June 14th 1878

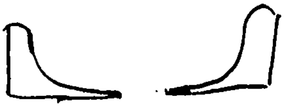
Technical Note: Phonograph

Speaking Phonograph

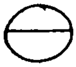
Experiments to get the hissing consonants reproduced better



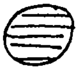
1 Mouthpiece used at first [sh?][a] and hisses no good[1]



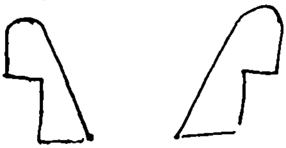
2 Made mouthpiece like this better hisses but not good



3 put watch spring crossways in No 1 mouth piece[2] ~~not~~ no better than No 2



~~3~~4 put in 5 springs like this:—no better



5 Made mouthpiece with larger hole and steep incline No better '~~h~~ishes'[b] than No 2[c]

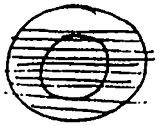
6[d] Took mouthpiece No 5 and pasted card on bottom and talked to it got it good but too low

7 Perforated card put ~~u~~on in No 6; perforated[e] with pin a number of times (about 25 holes) and talked through it. It gave the 'ishes' very plainly and I got excellent talking without any dampening of the diaphragm[3]

8 Made double diaphragm of Ferrotype plate but see nothing in it Diaphragms 1/16 apart.

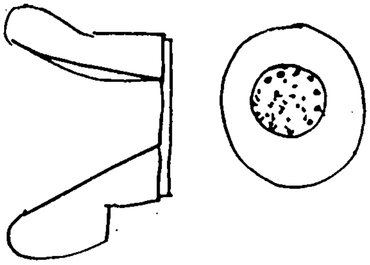
9 Perforated a number of small holes in the one nearest the mouth but it gave no better talking and nothing like experiment No 7[f]

10 Fastened a number of wires on bottom of mouthpiece so:—



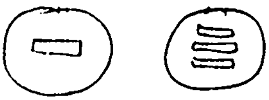
but no better result

11[g] Put solid piece of rubber on bottom of mouthpiece with number of perforated holes in so:—

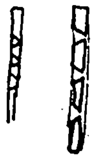


This does not work as well as the cardboard in No 7 perhaps it was because the cardboard had the burrs sticking up toward the mouth

12. put on bottom of mouthpiece discs with slot in so



and finally filed the 3 slots to a~~n~~ bevil~~l~~ edge so



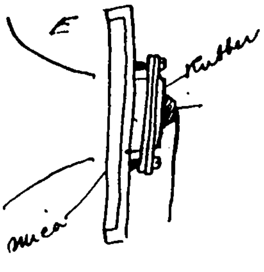
and turned it round and both sides to mouth no better

13[h] Try a number of mica discs 1/100 inch apart with hole in middle Result[4][i]

14 Try dampening the diaphragm when point is ri~~d~~gid on diaphragm Result[i]

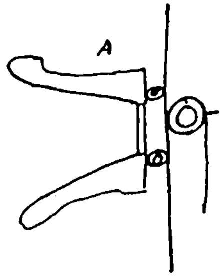
T A Edison
Martin N Force

Chas Batchelor
J Kruesi
G E Carman



Charles Batchelor's drawing of a mouthpiece arrangment using mica and rubber diaphragms (see n. 4).

X, NjWOE, Lab. Vol. 17:119 (*TAEM* 4:984). Written by Batchelor; multiply signed and dated. Each numbered paragraph separated by line drawn across page. [a]Illegible due to overwritten letters. [b]Underlined twice. [c]Followed by "turn over 2 pages" to indicate page turn. [d]"6" also written at top of page. [e]Interlined above. [f]Followed by "over" to indicate page turn. [g]Faint sketch overwritten by this paragraph. [h]"13" also written at top of page. [i]Several lines of blank space follow.



A more detailed drawing of the mouthpiece arrangement used in experiment number 1.

1. In a separate notebook of his own, Batchelor discussed these "Experiments to get clearer articulation in regard to the hissing consonants" and noted that they were the result of "our mouthpiece being deficient in this respect." In this entry, Batchelor also included a more detailed drawing of the mouthpiece they had been using. Cat. 1317:63, Batchelor (*TAEM* 90:688).

2. In his own notebook (see note 1), Batchelor drew a mouthpiece that he described as having "pieces of watch springs placed edgeways across the whole to increase the 's,' 'sh,' etc."

3. In his own notebook (see note 1), Batchelor noted that he had tried "two iron diaphragms with the one nearest to the mouth perforated with a number of holes but the plainest talking is to be got by an ordinary diaphragm with a piece of thick card perforated with a large number of holes in its centre and fastened to the end of the mouthpiece the burrs on the card turned to the mouth this without any dampers is the best talking for plainness I ever heard."

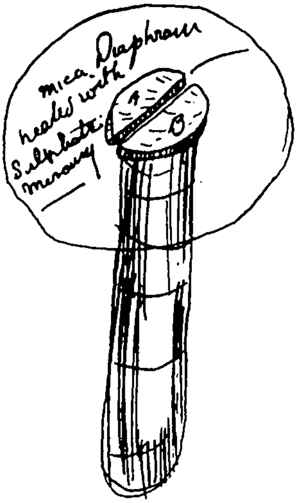
4. In his own notebook (see note 1), Batchelor indicated that he had "tried two Iron diaphragms and also 2 Mica diaphragms als[o] a very small rubber one and a mica one larger behind so:—"

-1357-

Technical Note: Telephony

[Menlo Park,] June 15th 1878

A New Telephone Receiver[1]



A and B poles[a] of battery with spermaciti inserted between—with mica diaphram treated with sulphate murcury[b]

The above is fair to loud—and a little louder than with mica diaphram with platina point[a]

No apparant change when spermaciti is out[a]

With diaphram without any sulphate of mercury but a very small amount of vibration can be detected[a]

Chas P Edison[2]

X, NjWOE, Lab. Vol. 14:117 (*TAEM* 4:270). Written by Charles Edison. [a]Preceded by canceled letter. [b]Followed by horizontal line drawn across page.

1. Text is "mica Diaphagm treated with Sulphate mercury." These experiments continue the effort to use chemical cores in telephone receivers (see Doc. 1215). A drawing of 12 June shows this design with the statement, "A and B with space between and insulated by with differant chemicals inserted bet. A & B." There follows a list of chemicals and results that are similar to those listed in connection with an alternative receiver design of 10 June. On 11 June, Charles Edison also made experiments with a "diaphram of mica rubbed with Emery paper until gloss is gone Sulphate Murcury rubbed on rough side." This worked "fair" but was "not quite as loud as carbon telephone." On 15 June he tried an experiment using two mica diaphragms treated with sulphate of mercury which worked "very good—about half as loud as the viberations of the Telephone." Vol. 14:115–17, 219, Lab. (*TAEM* 4:263–69, 272–74).

2. Charley had just returned to the laboratory at the beginning of June. He had been working at the Chicago and Lake Huron Railroad ticket office in Port Huron. Pitt Edison to TAE, c. April 1878; and Antoine Marontate to TAE, 23 May 1878; both DF (*TAEM* 19:395, 397); Vol. 14:103, Lab. (*TAEM* 4:248).

-1358-

From Lemuel Serrell

New York, June 18th 1878.[a]

My Dear Sir

I am sorry to hear of your being sick,[1] there are several matters needing attention: The following is the condition of these items: If you need me to come down relative to any matter let me know, and I will do so: The following are the items.—

1st I gave McLaughlin & Hickling letters of introduction to Brewer & Jensen and letters will go to their care:

I want your instructions as to the arrangements with them: The sale is to be for $17,500. to you: the money to be paid in England before July 31. May the same amount be paid in Australia? If not paid in England shall Brewer send assts. to a banker in Australia to be handed over in payment of the sum? Are you to have the sum named in one payment or is it to be divided up and apportioned to the different Australian countries? Do you want papers prepared for Tasmania, South Australia, New Zeland and Queensland, so that they will be ready for consumating purchase, when the proper party is found?—[2]

2nd Testimony on DeZuccato interference has to be taken before 28th ins. Who are the witnesses and when can they be produced? I wrote you 12th ins. and have not received any word as yet.—[3]

3rd Shall you be able to get together the facts relative to Acoustic interferences in time for preliminary statements?

4th The foreign patents are going on all correctly. I have no word from Mr Puskas, have kept him advised, have you any word from him?

5th The caveat on Micro Tasimeter will be sent down down as soon as it is complete: probably tomorrow.[4] I have been very busy and expected the pleasure of seeing you, or this would have been ready for today.

6th A Mr Warren Hidden[5] from Constantinople has been in and wants to see you, he thinks he has some great improvement to communicate to you, shall I advise him to come down and see you, or do you desire rest for a while so as to recuperate?— ⟨Have seen him⟩[6] Yours truly

Lemuel W. Serrell

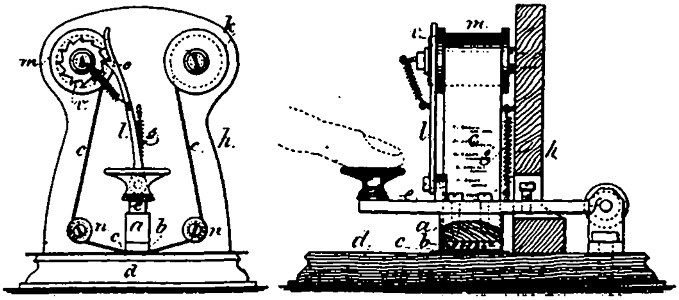
ALS, NjWOE, DF (*TAEM* 18:712). Letterhead of Lemuel Serrell. [a]"New York," and "187" preprinted.

1. This same day Serrell telegraphed Edison, "Shall I see you today about Australian agreements," to which Edison replied "Mr. S. L. Griffin my secretary is a notary and can attend to Australian papers. Please send by mail I am quite sick." DF (*TAEM* 18:711).

2. On 21 June, Serrell sent Edison the assignments for Victoria and New South Wales. Edison was to sign these and send them to Brewer and Jensen who would be instructed not to deliver them to McLaughlin and Hickling until they paid the $17,500. Serrell also asked again about instructions for the other Australian countries. Serrell to TAE, 21 June, with unsigned assignment papers, DF (*TAEM* 18:716–20).

3. Later this same day, Edison replied to Serrell asking that the taking of testimony be postponed and suggesting that one of his claims might have to be withdrawn. He also indicated that his witnesses would include Charles Batchelor and James Adams. Serrell had first asked Edison how he should handle the interference with Eugenio de Zuccato in a letter of 12 June. The interference concerned Edison's patent application for an addressing machine filed 10 May 1877, which finally issued as U.S. Patent 230,621 in August 1880. After Edison filed the original application, the patent examiner had declared that both claims were an-

Edison's patented design for an addressing machine using perforated paper strips.

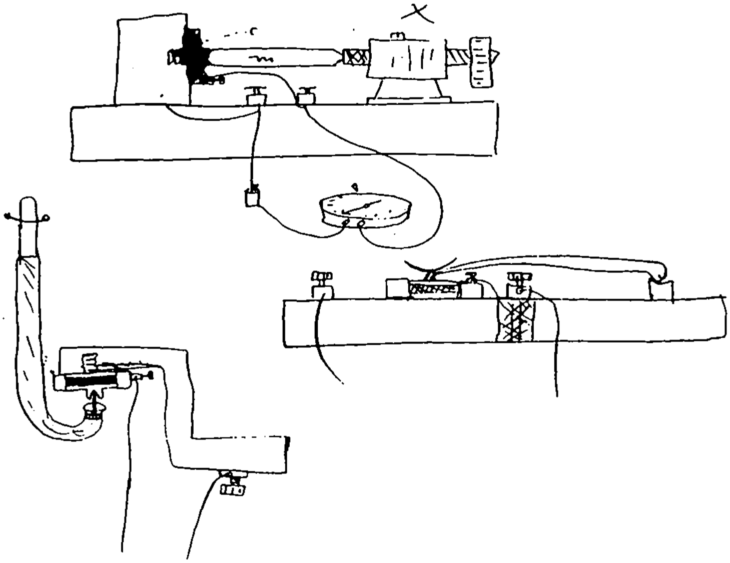


ticipated by prior patents. After Edison amended his application, however, the examiner found it to be anticipated by other patents and declared interferences that were subsequently decided in Edison's favor. Then, in March 1878, Serrell learned that de Zuccato's patent might anticipate Edison's and asked that this interference be declared. Testimony was to be taken in July, but was postponed again because of Edison's trip west. In November, Serrell arranged a conference to settle the matter. Edison subsequently had to amend his application twice, in May and December 1879, before it finally issued after he withdrew the second claim. Pat. App. 230,621; Serrell to TAE, 19 Mar., 12, 20, and 21 June, 10 and 13 July, 10 Oct., 7 and 11 Nov., 12 Dec. 1878, DF (*TAEM* 18:639, 710, 712, 714, 715, 725, 731, 772, 793, 802, 836).

4. Though this caveat (apparently numbered 81) has not been found, there appear to be draft drawings in NS-Undated-005, Lab. (*TAEM* 8:512–13). Edison never received a U.S. patent for the tasimeter, but three designs like those in the draft drawings (figs. 1, 4–5) are included in his British Patent 2,396 (1878, figs. 22, 42–43), including one modified for use as a telephone transmitter. A bill from Serrell dated 1 Sept. 1878 included charges for the week of 8–15 June for preparing and filing Caveat 81. Its subject was listed as "weight & pressure indicator" (DF [*TAEM* 18:741]).

5. Unidentified.

6. Edison wrote this across the paragraph regarding Hidden. Nothing is known about their meeting.



These three designs from Edison's tasimeter caveat draft became part of his British Patent 2,369 (1878).

-1359-

Technical Note: Telephony

[Menlo Park,] June 18th 1878

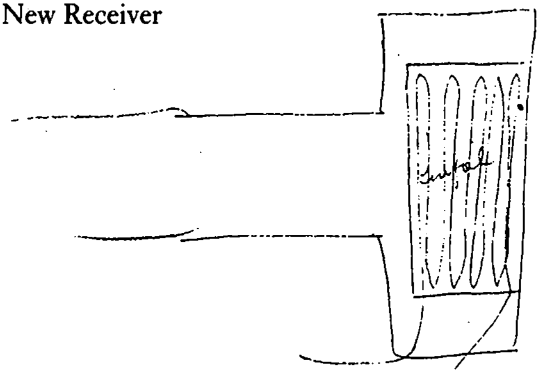
Speaking telephone

New Receiver Make receiver of spool ~~of~~and core of small discs of ferrotype plate punched out (Given M Force)[1a]

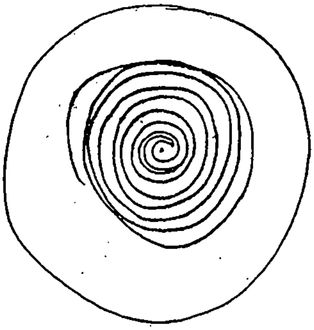
Make receiver of two ~~diaphragms~~ plates[b] with spirals of tin foil in order to see if there is any thing for us in parallel circuits Gave to Carman to make[a]

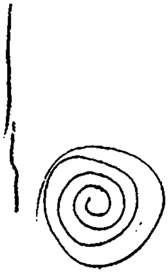
Make receiver

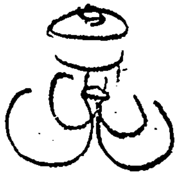
New Receiver

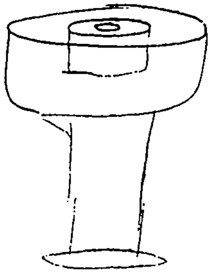


Take some of the ½ inch tissue paper and paste a thin strip of tinfoil on it so sas to make a long metallic band. This is to be laid [~~hor~~] so as to make a number of parallel circuits to use as a receiver—[2a]









Charles Batchelor's drawing for Martin Force of a new receiver with a "core made up of a number of discs of ferrotype plate," all insulated from each other.

Charles Batchelor   Geo E. Carman

X, NjWOE, Lab., Vol. 14:126, 124 (*TAEM* 4:281, 279). Written by Batchelor; multiply signed and dated. [a]Followed by centered horizontal line. [b]Interlined above.

1. Batchelor's drawing and instructions for Force are dated 19 June (Vol. 14:131, Lab. [*TAEM* 4:287]). Other receiver designs from that day include one with "Iron wire wound with copper and the end of wire fastened to a diaphragm" and another in which two steel bars were placed "in a spool with the ends magnetized so as to neutralize each other" (Vol. 14:128, 130, Lab. [*TAEM* 4:284, 286]). These designs are probably related to the experimental program laid out in Doc. 1215; they appear to mark the end of that line of work.

2. The following drawings may have been made by Carman as they are in a darker pencil that matches his signature.

-1360-

From Josiah Reiff

New York, June 21 1878[a]

My dear Edison

Griffin called today & has gone to Brooklyn to see a pair of ponies. If they are not satisfactory we shall look farther.[1]

It is an infamous shame that the man James for whom you have done so much for nothing, should hound E.H.J. sue him & finally compel him to pay an unjust debt[2] or allow his little Phonograph interest to be confiscated.

E.H.J. had to borrow $230 today to pay it or lose his stock—

By the way I read your criticism on Preece & Hughes—[3] The conduct of Preece as you state it, is quite consistent with what Morten[4] wrote, when he said Preece told him you had no interest in Quadruplex there, that it was Stearns & Prescott. You remember you laughed at Morten & said you were in correspondence with Preece who wrote you differently— I think the newspapers sympathize with you in the controversy. I want to see you, shall I come out or will you call. Yrs

JCR

ALS, NjWOE, DF (*TAEM* 15:821). Letterhead of J. C. Reiff. [a]"New York," and "187" preprinted.

1. Reiff began helping Edison find ponies for sale in May. This may be the subject to which Reiff referred on 9 May when he asked to see Edison about his "pet project." In an undated letter from about this time, Edison's brother Pitt wrote that Thomas ought to get "a pair that is a little stylish and good drivers and not afraid of the cars as you use them close by the RR I will see what I can buy in that line and let you know." By the end of May, Reiff had found three ponies that the seller described as "the handsomest team in Brooklyn" and asked Edison to come look at them, but he also continued to make inquiries. On 29 June, Edison purchased a pair of ponies and harness from the Brooklyn Riding Academy for $350. Reiff to TAE, 9 and 31 May, 8 June 1878; Pitt Edison to TAE, n.d.; receipt of payment; all DF (*TAEM* 15:633, 722, 765; 19:412; 17:286).

2. James James had loaned money to Johnson and attempted to collect it in March. Johnson did not reply to James's March letter, which he sent to Edison with the note, "this is simply a threat." James died suddenly on 23 June 1878. James to Johnson, 28 Mar. 1878; Johnson to TAE, 28 Mar. 1878; Felix Brown to TAE, 23 June 1878; all DF (*TAEM* 15:414, 831).

3. Reiff probably read Doc. 1348.

4. It is unclear whether Reiff is referring to Alexander Morten, who had been involved in Edison's work on the electric pen and domestic telegraph systems in the mid-1870s, to Henry Morton of the Stevens Institute, or to some other person.

-1361-

[Menlo Park,] June 21 1878[1]

Technical Note: Auriphone

Auruphone

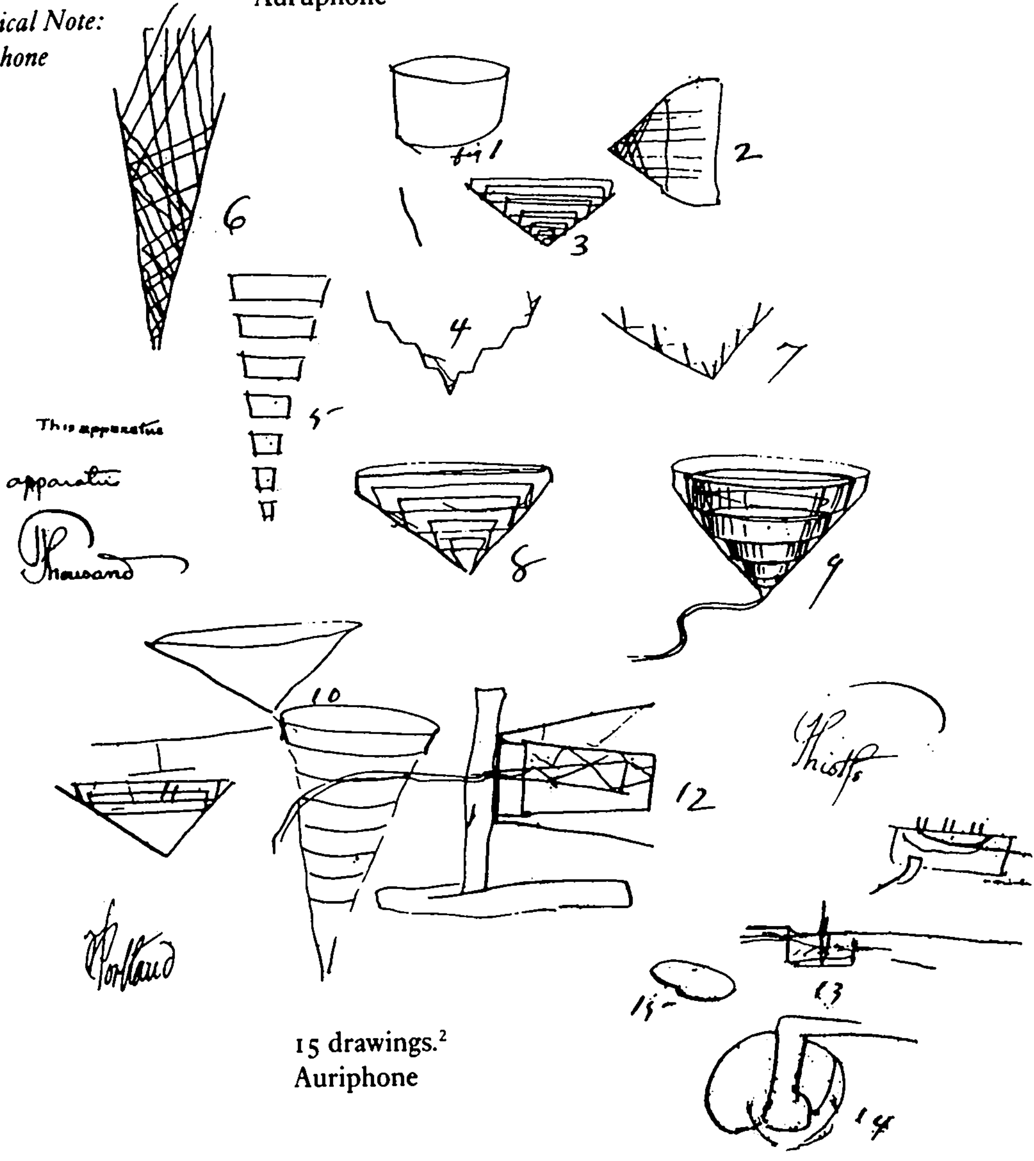
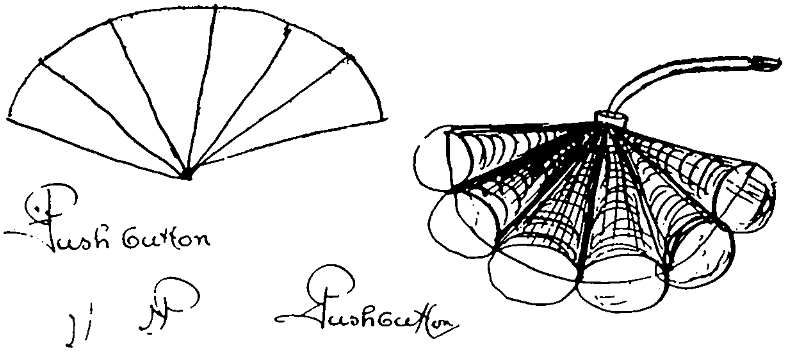
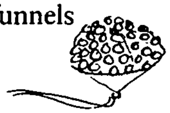


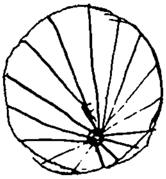
fig 1
2
3
6
4
5
7
This apparatus
apparatus
Thousand
8
9
10
12
Portland
13
15
14

15 drawings.[2]
Auriphone

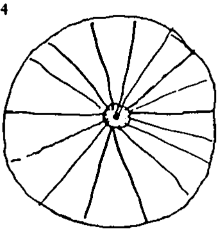

Push button
Pushbutton

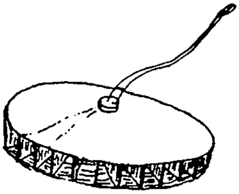
Megaphone[3] or rather Aurophone
boquet of funnels





Resonator[4]





T A Edison
J Kruesi

Chas Batchelor
G E Carman
M. N Force

X, NjWOE, Lab. NS-78-002 (*TAEM* 7:759, 761). Document multiply signed and dated.

1. The first drawings labeled "aurophone" were made on 19 June. On 22 June, Edison drew additional designs labeled "Auruphone for the deaf." NS-78-002, Lab. (*TAEM* 7:756, 762).

2. The drawings numbered 1–15 may have been intended for a caveat.

3. Edison initially invented the term megaphone to refer both to his telephonoscope and to the auriphone (also called aurophone or auruphone), though it was the former that came to be known by this word (see Doc. 1326 nn. 2–3; *OED*, s.v. "megaphone"; Prescott 1879, 561–63). The *New York Herald* of 8 June reported that Edison had just filed a megaphone caveat and described his plan to adapt the device for use as a hearing aid.

> By applying it to the ear at a high rate of adjustment a whisper can be distinctly heard 300 feet away. Already the professor has tested it sufficiently to be satisfied of its entire practicability. It is to be of small size and have attached to it a rubber tube. In the inventor's own words, "It can be taken to a theatre by a person hard of hearing just as a person near sighted now takes an opera glass. All you do is place it on your lap, let the tube touch your ear and all sounds come to you magnified fifty times if necessary. The loudness can be regulated for the ear as you regulate a telescope for the eye." ["The Megaphone," Cat. 1240, item 661, Batchelor (*TAEM* 94:227)]

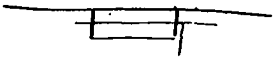
4. The 22 June auriphone drawings (see note 1) include what appear to be Helmholtz resonators (see *TAEB* 2:723 n. 5).

-1362-

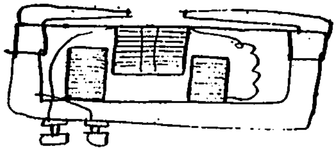
[Menlo Park,] June 21 1878

Technical Note: Miscellaneous

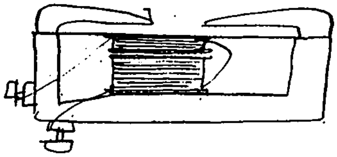
Telephone

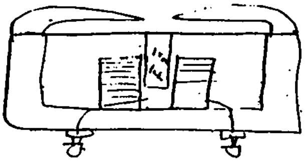


Receiver worked by mutual[a] attraction of coils one fixed & the other on the diaphragm both in same circuit.



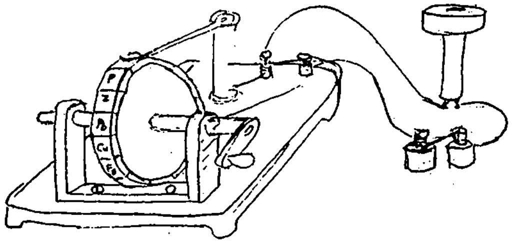
I will also mention that the fixed one may be placed in a local circuit

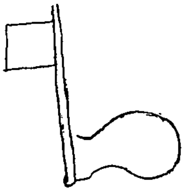




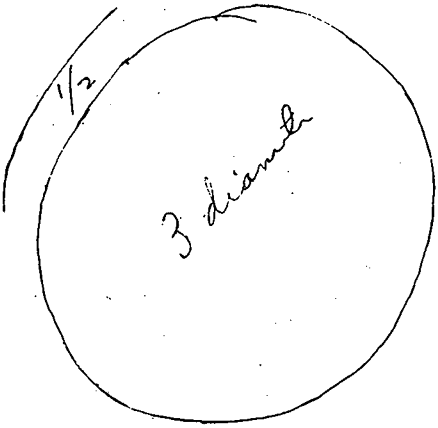
Suction or axial magnet[1]

Chemophone[2]





Copper[b]
Zinc[c]
Lead[c]
Tin[c]
Cadmium[d]
Platina[c]
Iron[c]
Silver[c]
Aluminum[c]
Nickel[d]



Microphone[3]

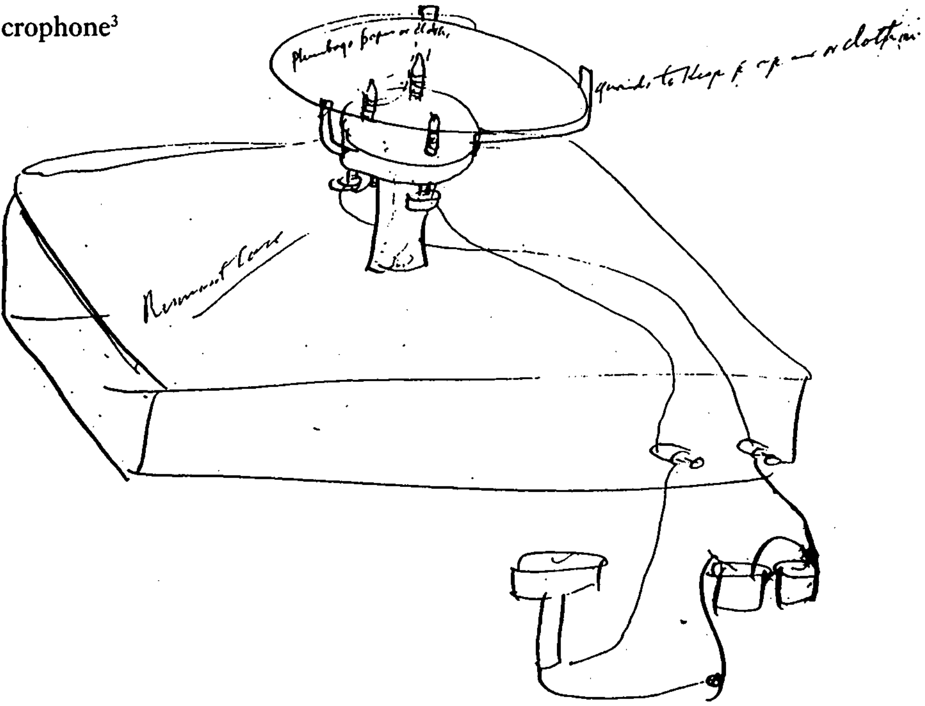
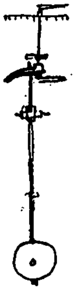
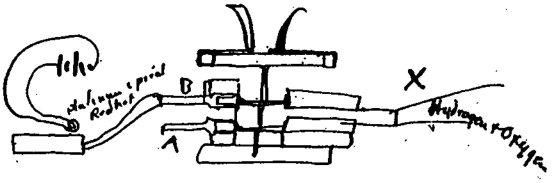

Plumbago paper or cloth
guide to keep p. up — or cloth
Resonant Case

Fig 1[4a]



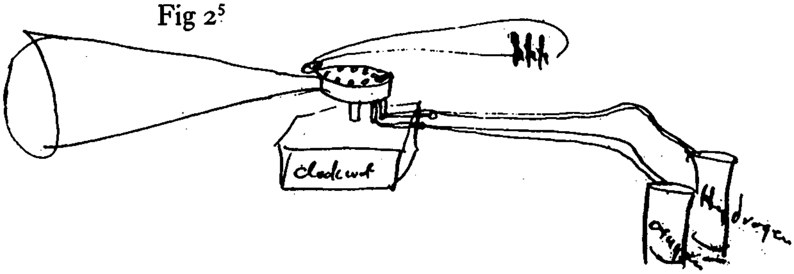

platinum spiral
Redhot
B
A
X
Hydrogen & Oxygen

Hydrogen pistol

Des[ign] 1[e] May arrange[f] it to let H pass in B & Oxygen in A & use X for pistol.

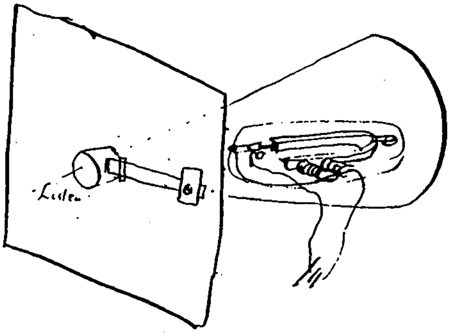
This will dispense with diaphragm and cylinder

Fig 2[5]


clockwk
Hydrogen
Oxygen

Des 2[g] Fog signal siren using explosion gases in chambers The chambers are filled automatically & explode by hot spir[al][h] as they come opposite funnel like colts revolver=

Narrow aperture leading from a continuous source of sound & expansion of rubber closes aperture to greater & lesser extent[6]



The Slot may be the same as a spectroscope and may be opened & closed by a magnet galvanometer needle etc or by a strip deriving motion from a diaphragm, having a cone mouthpiece=

T. A. Edison Chas Batchelor
J Kruesi G E Carman
M. N. Force

X, NjWOE, Lab., Vol. 14:132; NS-78-004; NS-78-002; NS-78-012 (*TAEM* 4:288; 7:799, 760, 758, 933). Document multiply signed and dated. [a]Interlined above. [b]Followed by "x." [c]Followed by check mark. [d]Followed by canceled mark. [e]Line drawn around following two sentences to designate as encompassing "Des 1." [f]Obscured overwritten letter. [g]Line drawn around following two sentences to designate as encompassing "Des 2." [h]Document damaged.

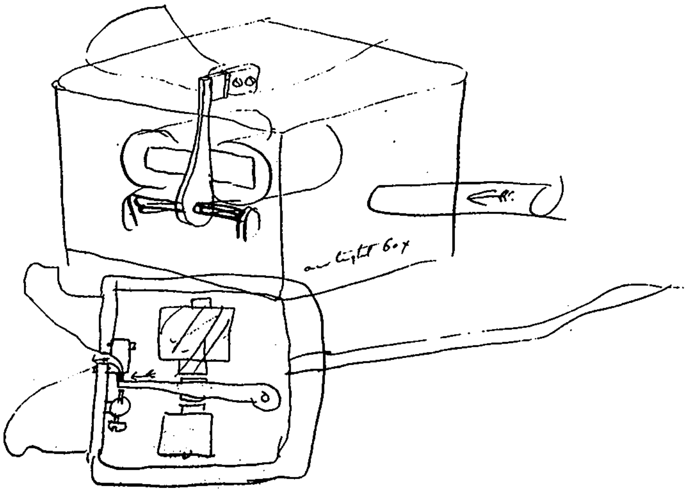
1. Text is "iron tube."

2. A measured drawing of this device was made by John Kruesi the same day (NS-78-004, Lab. [*TAEM* 7:801]). This appears to be an attempt to use the electromotograph principle in a telephone receiver circuit. An electromotograph testing device with a similar group of metals (it has brass but no cadmium or iron) is owned by Charles Hummel.

3. Text is "Resonant Case," "plumbago paper or cloth," and "guards to keep paper or cloth on." Edison also drew other microphone designs on 19 June. Vol. 14:129, Lab. (*TAEM* 4:285).

4. Text is "platinum spiral Red hot" and "Hydrogen & Oxygen." This and the following drawing are alternative designs for Edison's aerophone. Charles Batchelor made a measured drawing for an aerophone the same day (NS-78-002, Lab. [*TAEM* 7:757]), and two days later, Edison drew an idea for a telephone worked by compressed air like an aerophone (Vol. 14:138, Lab. [*TAEM* 4:295]).

Edison's design for an aerophone telephone.



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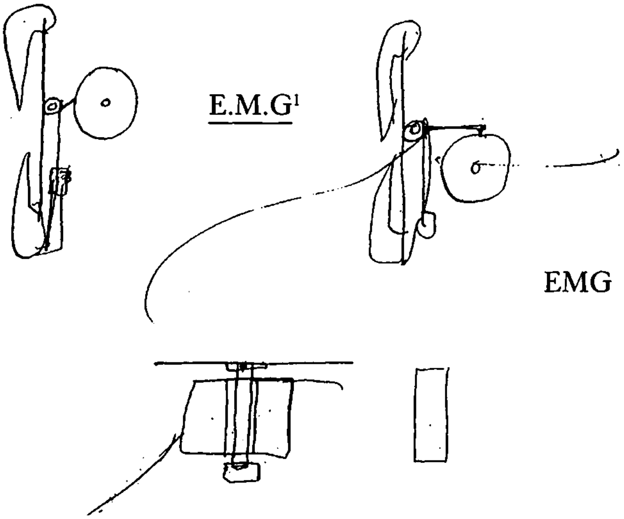
5. Text is "clockwork," "oxygen," and "Hydrogen."
6. Text is "Listen."

-1363-

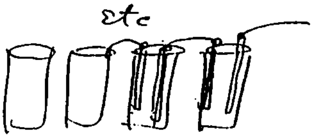
[Menlo Park,] June 23 1878

Technical Note: Telephony

Telephone



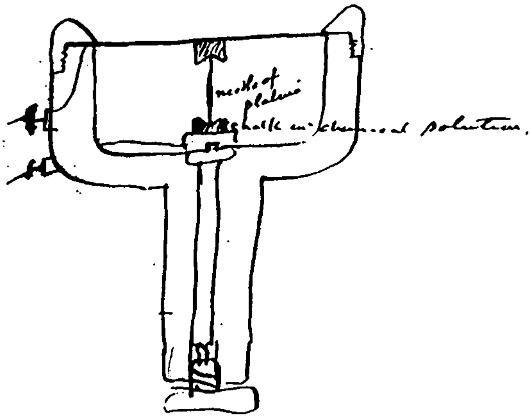
Expansion & contraction of cylinders in an Electric field They are connected to a diaphragm & serve to give motion to it=

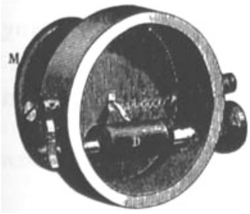


Multiple Aluminum Platina polarizers for telephone ckts=[2]
T A Edison

X, NjWOE, Lab., Vol. 14:136 (*TAEM* 4:293).

Edison drew on his summer 1876 electromotograph designs for this telephone receiver design.





A November 1877 electromotograph receiver.

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1. On 19 June the laboratory staff first returned to the use of an electromotograph receiver when Batchelor drew a circuit arrangement employing one with instructions to "try it this way first." These first designs used the wet-paper electromotograph receiver of 1877, but on 29 June, Edison drew receivers incorporating an electromotograph in which a needle pressed on a chalk cylinder similar to designs from summer 1876. Vol. 14:128, 139–40, Lab. (*TAEM* 4:284, 296–97); Docs. 781, 784, 787, 792, 873, 888–89, 908, 917, 932, 962, 973, and 980; see also a 23 November 1877 design shown in Prescott 1879, 549–50 (fig. 286).

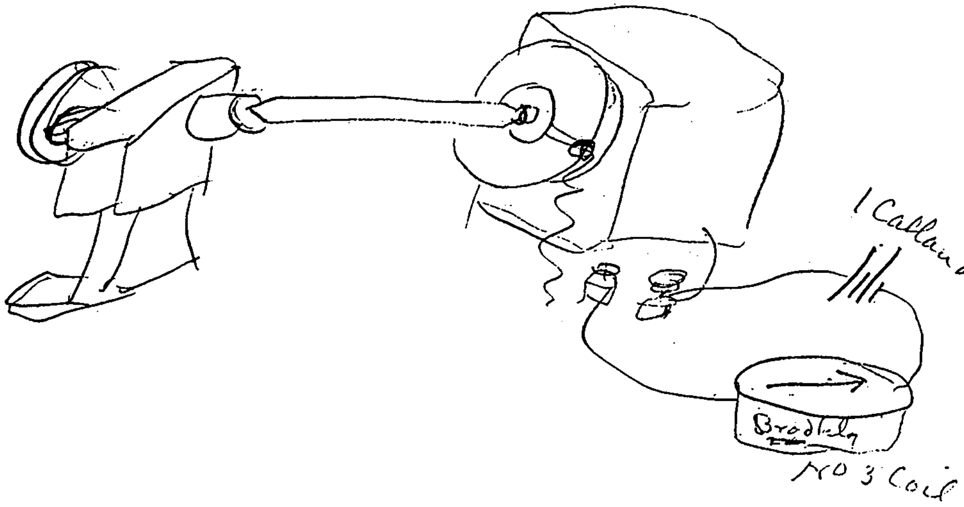
2. Two days earlier Edison had designed another "Apparatus for Polarizing a Telephone line." An account entry for this apparatus is dated 28 June. Vol. 14:134 and NS-78-001, both Lab. (*TAEM* 4:291, 7:723); Cat. 1185:231, Accts. (*TAEM* 22:660).

-1364-

Technical Note: Tasimeter

[Menlo Park,] June 23 1878[1]

Some experiments with vulcanized hard rubber in the tasimeter[2]



Paper[a] soaked in oil mirbane & held within ⅛ of inch from strip causes g[alvanometer] to deflect from 45 to 47 (note O Mirbane softens hard rubber in 3 weeks)

Creosote, d[itt]o from 45 to 46½—

Carbolic Acid, no effect

Benzine, Contracts owing to cold produced by evaporation

Cyanide Potassium[b] expands it from 45 to 47

Chloral Hydrate on end glass rod makes it go up ½ degree

Tungstate Soda end glass rod 1 deg— tried it after being exposed to air 20 minutes so it must be at same temperature

T A Edison

X, NjWOE, Lab., NS-78-009 (*TAEM* 7:893). [a]Obscured overwritten letter. [b]Underlined twice.

1. These experiments were apparently made with the original tasimeter arrangement (Doc. 1316). Though Edison had designed a new tasimeter arrangement in May and a measured drawing of the design had been made on 12 June, the first instrument was not finished until 25 June. This was sent to astronomer Charles Young at Princeton. The one Edison took with him to Rawlins, Wyo., was finished on 11 July, two days before he left. Docs. 1316, 1329, and 1401; Batchelor to Kruesi, n.d., NS-78-009, Lab. (*TAEM* 7:895).

2. Text is "1 Callaud" and "Brad[ley] telg ~~2-e~~ No 3 coil." A 10 July note indicates that the laboratory staff was planning some experiments that replaced the rubber with other materials, including aluminum, cadmium, copper, german silver, iron, nickel, lead, silver, zinc, platinum, and mica. NS-78-009, Lab. (*TAEM* 7:894).

-1365-

To George Gouraud

[Menlo Park,] June 24 1878[a]

My dear Gouraud

I see by "Iron" that Mr W. H. Preece appears in the lists of patentees as an inventor of [a?][b] Telephones;[1] You might see Brewer and Jensen Chancery Lane, and get an abstract of his provisional specification= I might give you some information and then you could give me a copy= Bailey= B appears to be a smart fellow but a diplomat[2] For the life of me (notwithstanding Popes letter)[3] I cannot see what Gray has in England= You will see by Pope's letter that he claims that Bells patent is no good If it is Grays aint any good because Grays is precisely like Bells except put in a different shape= They may talk and blow about the working of the Gray Telephone, but Bells is better and Bells will work any where that Grays will and many places where it will not= ~~Preece~~ If the [receiver?][b] is free nothing can touch us in England= No matter how many telephones come out there my complete apparatus will give more satisfaction, last longer and can be sold cheaper—besides it will work where no other telephone can work= We have greatly improved them since Adams left and the 6 that we[c] are going to send you will if the sea air dont hurt them prove perfectly satisfactory= My telephones unlike any other cannot be demagnetized by lightning= Preece has undoubtedly played a fine game with Adams; Adams writes that he has had no show, and that he thinks Preece is hostile to our telephone, underground wires have been given him at all times, he has had no assistance[4] My opinion is that nothing can be done with the Post office pirates.

Remember that the phonograph & Telephone is in one patent. Hence I had to make the contract with Nottage in the form of a Licence. With the telephone the same arrangement will have to be made= The parties make a contract with me for [~~arranging~~?][c] the sale and exclusive right during the life of the patent to make and sell telephones= I will have a copy of Nottages contract made and sent you so you will see the nature of the contract that must be made with other [parties on telephones?][d] I send you a provisional power of attorney= which will serve your purpose for a while=

I have written Adams to do what you require do not let him go near the P.O. people= See if you can get Clarke[5] or some one to set the Hughes steal right before the Society of Telegraph Engineers, or through the columns of some paper= I am preparing a pamphlet in which the whole steal is exposed=

Puskas never writes me; But you better see him He is a good fellow nevertheless= Is Nottage making any money[6] exhibiting receipts here so far $13 000. clear profit. & thats only 25 per cent of what was taken in at the doors= I will take $5000 for ⅕ of my interest in phonographs in England. My new phonograph patent there is secure and will be a clear one & voluminous[7] I may in the course of time take out others= The Toy talking Box here is a success We have made .6. of them & they work nicely— The Toy Co proposes to sell them for $3. each if they can do it. They will sell by the thousands= The toy business I going to be immense=[8]

Do things up well and I will let you bring out the new things Theres lots coming In haste

Thos A Edison

10 July I will probably ship you the telephones=[9]

P.S. My telephone big success on Western Union Lines=[10]

ENCLOSURE

[Menlo Park,] June 24 [187]8

I Thomas A Edison of Menlo Park state of New Jersey U.S.A. do hereby appoint Col George E Gouraud of London England my agent for negotiating a contract to cover the sale and exclusive licence to make and sell my Speaking Telephones in Great Britain.

Thomas A Edison

ALS (letterpress copy), NjWOE, Lbk. 3:300 (*TAEM* 28:744). [a]Date written in pencil, rest of letter in ink. [b]Obscured overwritten letters. [c]Faint copy. [d]Canceled.

1. The 8 June 1878 issue of *Iron* (11:723) identified William Preece as having filed for British Patent 2,202 (1878). Preece's amplifying receiver consisted of a polarized relay which, when actuated by current from the transmitter, conveyed its vibrating motion through a rigid wire to a diaphragm stretched across the narrow end of a conical tube. Although the receiver could be connected with any transmitter, "the patentee proposes in general to use the instrument known as Hughes' microphone." "Preece's Improvements in Telephones," *The English Mechanic,* Cat. 1241, item 1112, Batchelor (*TAEM* 94:453); reprinted in *Sci. Am. Supp.* 7 (15 Feb. 1879): 2591.

2. See Doc. 1349 n. 2.

3. Gouraud had apparently seen Franklin Pope's 22 March letter to William Preece, which discussed Elisha Gray's claims to priority on the telephone and asserted that Gray's English patent would stand against Bell's (WHP).

4. This letter has not been found. However, in a 19 June letter to Charles Batchelor, Adams reiterated that he had been "depending on

him [Preece] for wires and assistance to carry out my experiments." DF (*TAEM* 15:806).

5. Edison probably meant Josiah Latimer Clark.

6. On 25 June, Gouraud wrote to Edison regarding the phonograph, "I am afraid Nottage is not making the most of his material" (DF [*TAEM* 15:847]). Press reports available to Edison indicated many exhibitions were being held; for example, a clipping apparently from the *Telegraphic Journal and Electrical Review* of 15 June 1878 states, "The phonograph is being exhibited daily in action at the various establishments of the London Stereoscopic Company, who are sole licensees of Mr. Edison's patent" (Cat. 1030:18, Scraps. [*TAEM* 25:265]).

7. The preliminary specification for Edison's British Patent 1,644 (1878), covering phonograph developments, had been filed on 24 April. The full specification, filed in October, was very similar to Doc. 1341.

8. On 6 July, Charles Harris reported to Edison that "Numerous experiments have been made to perfect the Phonograph for toys &c, but (as you are aware) without complete success as yet. therefor there has not been any sales." This state of affairs continued through the summer. Harris to TAE, 6 July, 6 Aug., and 14 Sept. 1878, DF (*TAEM* 19:95, 103, 118); see also Doc. 1321 n. 2.

9. On 8 August, Edison sent two boxes, each containing four complete sets of telephones, by which time Gouraud had sent several anxious inquiries. TAE to Gouraud, 8 Aug. 1878, Lbk. 3:334 (*TAEM* 28:775); Gouraud to TAE, 25 June, 15 and 31 July, and 2 Aug. 1878, all DF (*TAEM* 19:847, 872, 884).

10. In a telegram dated only June, George Walker reported: "We are working your transmitter to our twenty third street of[fice]s over heavy induction and speaking in a low tone to the entire satisfaction of Mr Prescott and myself." DF (*TAEM* 19:733).

-1366-

To the Editor of the Scientific American

[Menlo Park,] June 24, 78[1]

To The Editor of the Scientific American

In reply to the communication of Messrs Pitt and Dopp[2] which appeared in your issue of June 29th under the heading of "The Microphone" I wish to say that had the above named gentlemen read carefully what I have said in regard to the variation in the electric conductivity of carbon and other semi-conductors when subjected to pressure, they would have saved themselves the trouble of writing you. I stated, and proved nearly two years ago that conductors of electricity when finely divided and moulded in the form of buttons varied their resistance by pressure and subsequently[a] that the whole effect was due to surface contact and not to intermolecular action. Mr M Richards, of the Colt Arms Co[3] also came to the same conclusion over [a year][b] ago. The explanation offered by Prof Hughes [which][b] your correspondents referred to is capable [of being][b] shown as absurd, and only tends to prove [that][b] he did not gain his information by experimental research but simply by piracy Respectfully

T. A. Edison

ALS (letterpress copy), NjWOE, Lbk. 3:298 (*TAEM* 28:743). [a]Interlined above. [b]Faint copy; text from printed letter.

1. This letter appeared in the 13 July 1878 issue of *Scientific American* (39:20). Cat. 1240, item 729, Batchelor (*TAEM* 94:255).

2. The letter from W. H. Pitt and W. H. Dopp, of the Central School Laboratory in Buffalo, New York, was published in the 29 June issue of *Scientific American* (38:404).

3. Edison meant Charles Richards (see Doc. 1045 n. 3). In July, Edison told a reporter for the *New York World* that he had just received a letter from "Mr. Bradford, of the Colt's Fire-Arms Works, in Hartford, in which he says he made experiments in 1877 to determine if the variation in the electrical conductivity of graphite under change of pressure is due to changes in the interior of the material or to variations of the battery contacts. He found that it was the latter—that is, the changes were all on the surface" ("Edison's Anger Excited," *New York World*, 9 July 1878, 1).

-1367-

To the Editor of the New York Daily Tribune

Menlo Park, N.J., June 26, 1878.[1a]

SIR:

In reply to the card of Messrs. Preece and Hughes, regarding the piracy by the latter of my carbon telephone,[2] as contained in your paper of this date, allow me to refute their statements by their own words, and by extracts from the English scientific papers. I quote from their card:

Hughes has not brought out any thermopile."

W. H. PREECE.

I emphatically indorse every word of the above message.

D. E. HUGHES.

From the Engineer, May 17, 1878.

> Professor D. E. Hughes's telephone, microphone, and thermopile— * * * A discovery not made till after Professor Hughes's paper was read before the Royal Society, points out another field of usefulness for this instrument. We all know what excellent service the thermopile has done in the hands of Professor Tyndall and other investigators of heat, but we think we may safely describe another kind of thermopile, as sensitive and far less complicated, less difficult to construct and less expensive than that compounded of zinc and antimony in the usual fash-

> ion. Instead of the glass tube as described, Professor Hughes was experimenting with a quill, and found that the instrument was exceedingly sensitive to heat. On the approach of a warm hand the galvanometer needle swings violently in one direction; on cooling the tube swings in the other.

Again I quote from the article on the telephone and phonograph from *The Washington Star,* April 19, 1878:[3]

> My carbon telephone may be used as a heat measurer (thermopile). It will detect the 50,000th part of a degree Fahrenheit, etc

This paper was mailed to Mr. Preece April 20, 1878, and I prove that he received it by quoting from the same article the following:

> The phonograph will preserve the exact pronunciation. The president of the Philological Society means to travel with it amongst all the North American tribes.

I quote from a lecture delivered by Mr. Preece before the Society of Arts, May 10, 1878, and published in their journal, page 537:

> The phonograph will preserve the exact pronunciation. The president of the Philological Society means to travel with it amongst all the North American tribes.

To set at rest the claims of Hughes on this subject, I quote from a letter received by me a short time since from Professor Langley,[4] the eminent astronomer:

> ALLEGHENY OBSERVATORY, June 4, 1878.
>
> In response to your inquiry, I may state that, to the best of my recollection, in October, 1877, at your laboratory in Menlo Park, on my telling you that an instrument more sensitive to radiant heat than the bismuth-antimony linear pile was desired by me for certain researches in the spectrum, you suggested the use of carbon, of which you were showing Professor Barker and myself specimens. As well as I remember, the idea you gave me was that the common small thermopile was capable of developing little energy. The variation of resistance of the carbon under the influence of pressure or traction from a small heated adjacent body might be made to control the energy of a

battery of any size, and thus multiply the sensitiveness of the pile almost without limit.

Mr. Preece, in his card, says:

> *His (Hughes's) microphone is quite a different instrument to Edison's telephone.*

Hughes, in his original paper of May 8, 1878, after summing up the labors of others, says:

> It will be seen, however, that in the experiments made by myself, the diaphragm has been altogether discarded, resting as it does upon the changes produced by molecular action, and that the variation in the strengths of the current flowing are produced simply and solely by the direct effect of its sonorous vibrations.

I quote from *The Journal of the Telegraph,* April 16, 1878 (of which paper Mr. Preece is a subscriber), an article taken from the proof sheets of Mr. Prescott's book on the telephone and phonograph, which reads as follows:

> In the latest form of transmitter which Mr. Edison has introduced, the vibrating diaphragm is done away with altogether.

From this book, which is now published, I quote from page 226:

> I (Edison) discovered that my principle, unlike all other acoustical devices for the transmission of speech, did not require any vibration of the diaphragm. That, in fact, sound waves could be transformed into electrical pulsations without the movement of any intervening mechanism.

This statement by myself, for publication in Mr. Prescott's book, was written over four months ago.

I quote from a letter from Preece to myself dated London, May 23, 1878:[5]

> Hughes's doings border very closely upon yours, and it is difficult to distinguish between what you have done and what he has done.

Again, Mr. Hughes, after describing a number of experiments, sums up and says:

> Carbon is used in preference to any other material. * * * It is quite evident that these effects are due to a difference of pressure at the different points of contact.

I quote from *The Journal of the Telegraph,* April 16, 1878:

> By constant experimenting Mr. Edison at length made the discovery that, when properly prepared, carbon possessed the remarkable property of changing its resistance with pressure, and that the ratios of these changes, moreover, corresponded exactly with the pressure.

The same discovery was published in *The Scientific American* of July 17, 1877, *Journal of the Telegraph,* July 15, 1877, *Harper's Magazine,* December, 1877, and many other papers, both in this and other countries.

I quote an extract from a letter addressed to Sir Henry Thompson,[6] the eminent surgeon, a copy of which was kindly sent to me by the writer:

> HOTEL CHATHAM, Paris, June 7, 1878.
>
> MY DEAR SIR HENRY: * * * It is certain that at the meeting of the British Association at Plymouth last September, a method of magnifying sound in an electric telephone was described as having been invented by Edison, which was identical in principle and in some details with that brought forward by Hughes.
>
> [Signed] WILLIAM THOMSON.

Finally, Mr. Preece had ample knowledge, through my correspondence with him, of all I had been doing since he left America, and had my telephones in his possession at least a month before the alleged discovery by Hughes, and it is almost impossible to attribute his failure to defend me (as he was bound to do) against the piracy of Hughes, to his not understanding so simple an instrument, and the principle involved therein.

Mr. Preece says in his card of yesterday:—

> I am in no way whatever a coadjutor of Hughes.

I quote from Hughes's original paper announcing his alleged discovery:

> My warmest thanks are due to Mr. W. H. Preece, electrician of the Post Office, for his appreciation of the importance of the facts I have stated, and for his kind counsel and aid in the preparation of this paper.

In closing this letter, allow me to mention that Mr. Hughes has addressed a communication to the French Academy of Sciences, in which he adds to his pirated telephone the induction coil, which I have always used in combination therewith, and which alone makes it a practical instrument, thinking perhaps that under cover of a foreign language and before a society whose proceedings are not generally known in this country, he would gain for himself the credit of this combination. He makes no mention of this all-important factor in England, where it would be at once known, and in which country it has been patented nearly a year. Yours truly,

THOMAS A. EDISON.

PL, *New York Daily Tribune,* 27 June 1878, 5. In Cat. 1240, item 707, Batchelor (*TAEM* 94:246). [a]Place and date not those of publication.

1. Two drafts of Edison's letter exist. One is in his hand and the other is a revised copy made by Stockton Griffin. The latter version is substantially the same as that which the *New York Daily Tribune* published on 27 June, except that Griffin left blank spaces for the long quotations; it also lacks the concluding paragraph. Edison's letter also appeared in the *New York Herald* of 27 June. DF (*TAEM* 17:122, 116); "Edison and Hughes," Cat. 1240, item 699, Batchelor (*TAEM* 94:241).

2. Earlier in the day, the *Tribune's* editor, Whitelaw Reid, had wired Edison, "Card from Preece and Hughes of today requires a letter from you imperatively necessary. Can you send it soon. will send out Reporter if necessary" (DF [*TAEM* 17:115]). This "card" was a cable to the New York Associated Press:

> Pray give the most absolute and unqualified denial to the statements made by Edison respecting me. Hughes has not brought out any thermopile. His microphone is quite a different instrument to Edison's telephone. It was worked out without any communication with me or information imparted by me in any way whatever. I knew nothing of it until it was shown to me, together with Professor Huxley and Mr. Norman Lockyer. I am in no way whatever a coadjutor of Hughes. W. H. Preece ["Edison and Hughes," *New York Herald,* 27 June 1878, Cat. 1240, item 699, Batchelor (*TAEM* 94:241)]

Hughes's emphatic indorsement, quoted in full by Edison, followed.

Unlike other New York papers, the *New York Daily Tribune* had reacted temperately to the microphone controversy and did not rush to take Edison's side. In its editorial on Edison's 8 June letter to the editor (Doc. 1348), the *Tribune* stated: "It must be granted on all hands that the discoveries of Mr. Edison suggested the line of experiment which led to the microphone, and it may prove difficult to draw the exact line at which the English instrument can claim any originality. As a whole, however, it is of simpler construction than previous telephones, and it seems, according to the accounts furnished, to have more remarkable powers." Cat. 1240, item 665, Batchelor (*TAEM* 94:229).

3. "National Academy of Sciences," Cat. 1240, item 537, Batchelor (*TAEM* 94:171).

4. Langley had written this letter at Edison's request (Langley to TAE, 7 and 11 June 1878, DF [*TAEM* 15:760, 776]). Edison replied to Langley on 13 June: "Please accept thanks for the statement. It will form an important factor in my forth-coming pamphlet which I am at present compiling— I will endeavor to show up Messrs Hughes Preece & Co in a manner, which to gentlemen will not be gratifying. This pamphlet will be soon broadcast on both sides of the ocean" (Lbk. 3:271 [*TAEM* 28:719]). See Docs. 1095A and 1135.

5. See Doc. 1339 n. 3. Transcriptions of this letter give its date as 22 May.

6. Sir Henry Thompson, emeritus professor of surgery and pathology at University College Hospital, London, was a noted amateur astronomer. *DNB,* s.v. "Thompson, Sir Henry"; see also Doc. 1347 n. 1.

-1368-

To James Redpath

[Menlo Park,] June 27 78

Jas Redpath

Referring to the Palmieri[1] matter—let Mr P see Mr Cheever about British Guiana—[2] I do not wish to change existing arrangements with Mr P let him go and exhibit and not sell insts—

Please inform me when you close matters as I have other applications for that territory

T.A.E. G[riffin]

L (copy), NjWOE, DF (*TAEM* 97:681). Written by Stockton Griffin.

[1] Henry Palmieri had written Edison on 12 June, identifying himself as a "brother inventor" and asking for an agency for the phonograph. Nothing further is known about him apart from his letterhead, which identified him as connected with the Palmo Sun Shade Co. of New York. DF (*TAEM* 19:258).

Edison answered Palmieri on the 13th and suggested he go see Redpath, who indicated that the West Indies were the only territory still available. Redpath apparently settled on a $1,000 royalty for Palmieri to exhibit the phonograph and indicated to Edison that Palmieri also wanted to exhibit the speaking and musical telephones. Edison indicated that he would be willing to provide speaking telephones at a low price, but that he would have to see Edward Johnson about the musical telephone. Palmieri to TAE, 14 June 1878; Redpath to TAE, 17 and 22 June 1878; all DF (*TAEM* 19:260–61, 268); TAE to Redpath, 18 June 1878, Lbk. 3:280 (*TAEM* 28:728).

[2] This letter is written on the back of Redpath's letter to Edison of 22 June in which he had enclosed Palmieri's letter regarding an agency for the West Indies. Palmieri had requested that British Guiana be included in his territory and Redpath told Edison, "Cheever suggested that it might, some time since. As I do not know who has the right of supplying the machines to go to the West Indies, I put in in that sen-

tence about your indicating the price of them." On 28 June Redpath replied that "I think I had better refer Mr Palmieri to you direct. You can get 25 per ct from him. But he is an interrogation point in breeches & I can't answer all his cunundrums about protection, patents & the like." As there is no further correspondence with or about Palmieri, it is possible that no arrangement was finalized. DF (*TAEM* 97:680–81, 19:271).

NEW HAND-CRANK PHONOGRAPH Doc. 1369

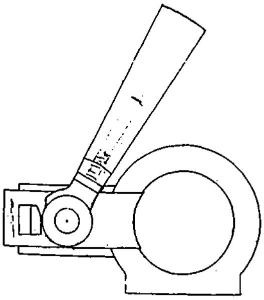
This is the second of Edison's phonograph designs to incorporate a flywheel. The flywheel used in this design was much larger and heavier than those Edison had used earlier in the year (Doc. 1166). In an April amendment to a patent application filed in March 1879, he described the reason for adopting this new flywheel.

> In experimenting with my phonograph I discovered that the reproduction of the sound was imperfect if the slightest variation occurred in the speed, hence the combination with the cylinder of a very heavy fly wheel in proportion to the cylinder, rendered perfect and reliable the action of the instrument in receiving and reproducing the sound, by equalising the speed.

The "abnormally heavy fly-wheel" enabled Edison "to insure great uniformity of speed and prevent irregularity in the movement by inaccuracies of work, dust, lack of oil, or any other source of local friction or resistance." By turning the cylinder at a uniform speed, he improved "the accuracy of reproduction, especially in musical sounds, that depend for their tone upon the number of vibrations per second."[1]

This phonograph also incorporated other improvements. It had a modified version of the "throw-out" mechanism first introduced in April. This device projected from the end of the stanchion on the side opposite the flywheel. It had a grooved face that engaged the thread of the shaft when pressed against it by the clamp. After recording, the clamp was released, which allowed the shaft to be disengaged, and when the mouthpiece was also withdrawn, the shaft and cylinder could be quickly slid, rather than turned, back to the starting position. The sound could be reproduced once the device engaged the thread on the shaft again.[2] As in the first flywheel model, the mouthpiece was placed on an arm that could be swung out and away from the cylinder when changing foil or preparing to reproduce sound.[3] Fastening the tinfoil smoothly and securely was made easier by having a bar on movable slides crimp the tinfoil firmly into a slot on the cylinder, which also simplified the foil's removal.[4]

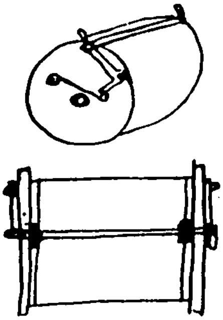
Edison had begun working on this design in May and had at least one prototype completed by early June, when Alex Pool examined a sample machine.[5] Edison arranged for Pool to manufacture ten machines for forty dollars apiece and intended to order another hundred if the design proved satisfactory. They were intended for exhibition and sale in those countries where Edison retained control of the phonograph business.[6] Some minor changes were made to the design while the patterns were being drawn, and at least one more feature, the modified throw-out, was incorporated into the finished machines.[7] The relation between this design and the "new instrument supplied by Mr. Edison" that was exhibited in New York in June and referred to in the press as the "musical phonograph" is not certain.[8] In any case, the new design differed significantly from the hand-powered phonographs then being operated in most commercial exhibitions around the country, which lacked the flywheel and other modifications.[9] The phonographs were finished by 16 August and arrived at Menlo Park by 21 August, when Doc. 1369 was photographed.[10]



The 23 June design for the throw-out mechanism.

1. Although Edison described the use of the heavy flywheel in a March 1879 patent application, which issued in May 1880, he was not allowed to include it in his claims because it "did not require invention" (H. C. Townsend to TAE, 19 May 1879, Pat. App. 227,679). The large flywheel first appears in a full-size measured drawing (later divided and damaged) of 15 May (Vol. 17:98–99, NS-Undated-004, both Lab. [*TAEM* 4:966–67, 8:199–200]). By the end of June, Sigmund Bergmann began including a flywheel on some of the exhibition phonographs his shop made for the company (Doc. 1419).

2. The throw-out on the finished machine matched the revised design of 23 June (Vol. 17:126, Lab. [*TAEM* 4:991]). In this design the grooved tooth slides to and from the shaft from the (rear) side while a collar remains unbroken around it. In previous designs the tooth was brought down to the shaft by a lever from above, which in some versions was also the top portion of the collar (see Vol. 17:75, 78, 97, Lab. [*TAEM* 4:942, 945, 965]); see Doc. 1310 for the original design. The earliest indication of such a projection is a drawing from 4 May; a measured drawing for the basic horizontal support piece is dated 13 May (Vol. 17:88, NS-78-007, both Lab. [*TAEM* 4:957, 7:874]). The general principle of using smooth journals and bearings, with the threaded portion of the shaft removed from the stanchions and otherwise engaged, was variously shown in earlier drawings; Doc. 1311 may indicate that it had already been put into practice in some way by the beginning of May. Another improvement may have been one described in the 15 July *Tele-*



The crimp-bar connections Edison designed on 10 May.

graphic Journal and Electrical Review: "Edison has improved the phonograph so that if spoken to at a distance of 13 feet it will intelligibly reproduce the speech. This increased sensitiveness is largely due to steel bearings having been supplied to the cylinder, so as to give it unvarying uniformity of motion" (Cat. 1030:20, Scraps [*TAEM* 25:266]).

3. The particular shape of the arm on this machine, like that of the stanchions, does not match that on any other known phonograph. A measured drawing for the stanchions is on the back of a 3 April 1878 telephone design. Vol. 14:81, Lab. (*TAEM* 4:225).

4. This crimping arrangement first appeared in a drawing of 10 May (NS-78-007, Lab. [*TAEM* 7:873]). Edison also considered several alternative designs (Docs. 1310 and 1341; Vol. 17:85–87, 105–6, 110–11, Lab. [*TAEM* 4:954–56, 972–73, 977–78]).

5. Early in May, Edison told Theodore Puskas he intended to make a new type of hand-powered phonograph and two weeks later indicated that he was making such machine. An account record for the "New Hand Phonograph" was begun on 20 May. Docs. 1317 and 1332; Cat. 1185:61, 202, Accts. (*TAEM* 22:637, 647).

Alex Pool & Co. was a Newark machine shop that manufactured to order various small products such as patented machinery and special tools. It was one of several shops responding to word that Edison was considering an order of one hundred phonographs. Edward Bullard to TAE, 17 May 1878; James Partrick to TAE, 21 May 1878; Pool & Co. to TAE, 5 June 1878; V. H. Ernst to TAE, 14 June 1878; Hope Machine Works to TAE, 27 June 1878; all DF (*TAEM* 19:68, 72, 80, 87, 90).

6. See, e.g., Doc. 1372.

7. Modifications to the mouthpiece were mentioned by Edison in a 14 June letter to Pool & Co. (Lbk. 3:273 [*TAEM* 28:721]) before all the patterns were sent, and the throw-out used in this phonograph first appears in a measured drawing of 23 June (Vol. 17:126, Lab. [*TAEM* 4:991]). The ten phonographs manufactured by Pool & Co. also differed from the original prototype in using brass rather than steel for some of the nuts as well as a less expensive grade of steel for the shaft. Some changes were apparently made just before Edison told a reporter on 8 July that he had finished a new phonograph the night before

> and everybody in Menlo Park came in and sat until 1 o'clock in the morning listening to it. It is perfect in its construction and its singing is delightful. You should hear it give music backwards. We get lots of new tunes that way. I've sent it to Newark [presumably to Pool], and, if they can make any as good as it, I'm going to have a hundred. ["Edison's Anger Excited," *New York World,* 9 July 1878, 1]

Pool & Co. also reported on 18 July that they had "received again the sample Phonograph." TAE to Pool & Co., 10 and 11 June 1878, Lbk. 3:261, 265 (*TAEM* 28:710, 714); Pool & Co. to TAE, 5 and 10 June 1878; Pool & Co. to Batchelor, 18 July 1878; all DF (*TAEM* 19:80, 85, 98).

8. Edison, rather than Edward Johnson or others in the phonograph company, provided a machine on 3 June (apparently from Menlo Park) for a company-arranged exhibition concert that opened that evening at

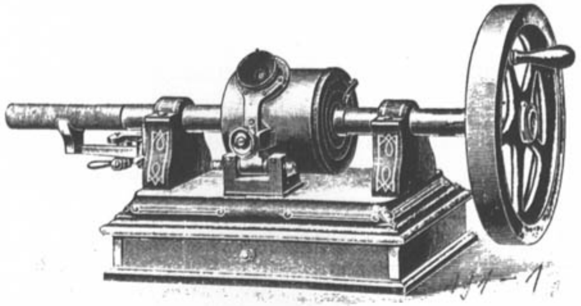
Irving Hall in New York. That phonograph apparently reproduced complex music more accurately than any previous machine. Stockton Griffin to Charles Cheever, 3 June 1878, DF (*TAEM* 19:79); exhibition ticket and reception invitation, Edison Speaking Speaking Phonograph Co., PPC (*TAEM* 96:518); "The Phonograph Wins a Victory," *Sci. Am.*, 22 June 1878, Cat. 1030:28, Scraps. (*TAEM* 25:271); "The Musical Phonograph," *New York Herald*, reprinted in *Sci. Am.*, 38 (1878): 405; also cf. "Edison." *The Chicago Tribune*, 12 July 1878, 3.

An advertising flyer for the final concerts in the exhibition series asserted:

> The Phonograph used at these Exhibitions embodies the latest improvements made by Mr. Edison, and clearly demonstrates that under his wonderfully fertile brain and persistent energy this—his most marvelous invention—is rapidly approaching perfection in all its detail, thus substantiating the claim that human speech may henceforth be permanently retained. [CR (*TAEM* 96:518)]

9. For accounts of phonographs then being exhibited see "The Phonograph," *Toledo Blade*, 15 May 1878; "The Modern Miracle," *Chicago Evening Journal*, 21 May 1878; and "Edison's Phonograph," *San Francisco Chronicle*, 28 May 1878; Cat. 1029:59, 99, 136, Scraps. (*TAEM* 25:190, 214, 233); cf. Docs. 1276 n. 1 and 1397 n. 1.

10. Pool & Co. notified Batchelor on 8 August that the first phonograph was "completed & ready for your inspection— we have proved it & find it works well— please call & examine." Batchelor apparently visited the Pool & Co. shop by 15 August, when he recorded the decision to move the threaded part of the throw-out from the back of the shaft to the bottom. The machines were ready the next day and were probably at Menlo Park by 18 August, when Batchelor listed five items "To be altered from Pool & Co Model." These included bearings of "antifriction metal" in adjustable housings and a new mounting for the mouthpiece. He also considered sliding the shaft through a sleeve in the cylinder and attaching it with screws. The Deutsches Museum in Munich has a machine with those modifications on a base from the 1880s. Pool & Co. to Batchelor, 8 and 16 Aug. 1878, DF (*TAEM* 19:104, 106); Vol 17:132, 135–38, Lab. (*TAEM* 4:996, 999–1002); Deutsches Museum Inventory No. 2463.

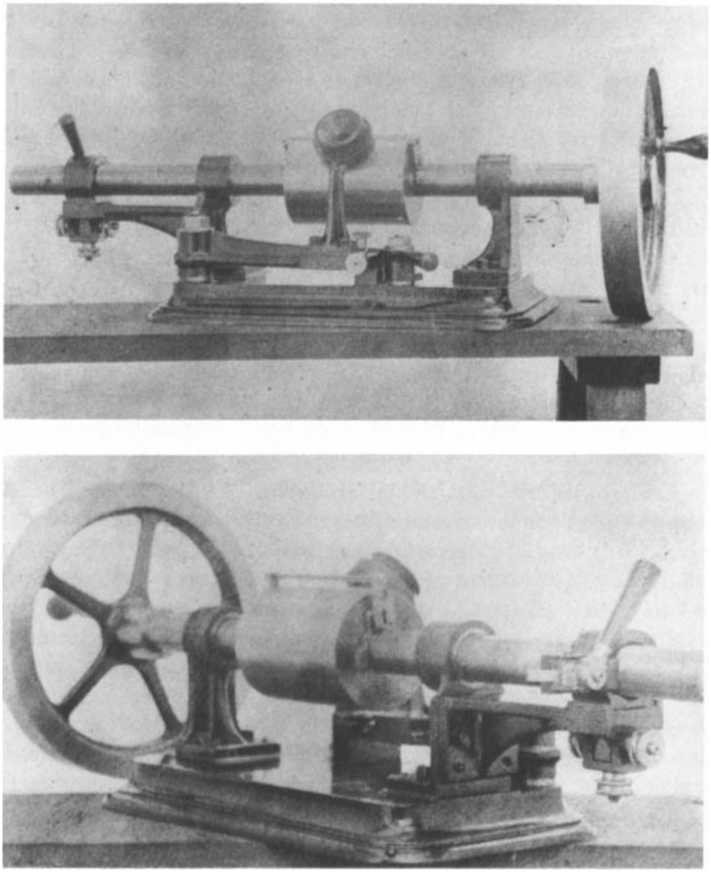


This hand phonograph, with shaft, cylinder, and flywheel as in the June design, includes modifications decided upon in August.

-1369-

[Menlo Park, June 1878?]

Production Model: Phonograph[1]



M (historic photographs), NjWOE, Album 76.015, p. 13.

[1] See headnote above.

-4- July–August 1878

Edison spent most of the summer in the western United States after leaving on 13 July with George Barker to join Henry Draper's solar eclipse expedition at Rawlins, Wyoming.[1] Edison had another reason for this trip. As he told a reporter who saw him off at the Pennsylvania Railroad,

> I can hardly wait until I get there. This is the first vacation I have had in a long time, and I mean to enjoy it. I have never seen the country. For the present, I am in the hands of my friends, and I think they intend to go directly through. After we have made the observations, however, I am going further West, to take in the Yosemite, San Francisco and a portion of the coast.[2]

Before leaving on his western trip, Edison spent several days with Batchelor investigating noise problems on the Metropolitan Elevated Railroad in New York City. This investigation, which was closely followed by the New York press, had been arranged by the railroad's attorney Grosvenor Lowrey, who knew Edison from his work as Western Union's corporate attorney. Batchelor continued the investigations after Edison departed.

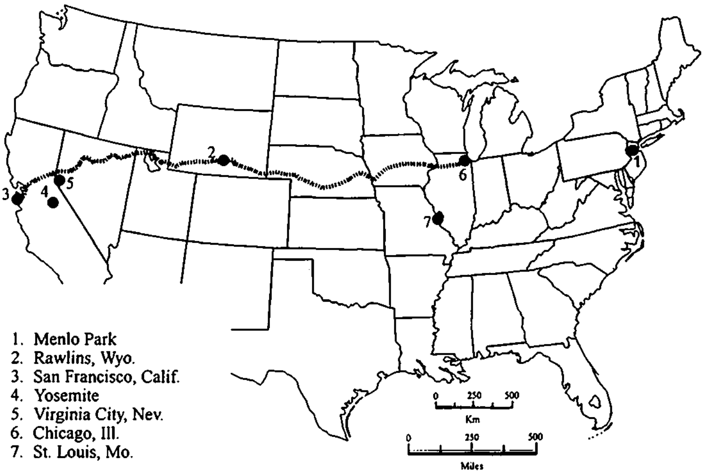
Edison planned to use his new tasimeter to measure the heat of the sun's corona during the eclipse. After arriving in Rawlins, he set up his tasimeter in a henhouse and tested it by measuring the heat of the star Arcturus. On 29 July, the day of the eclipse, a strong wind made observing conditions particularly difficult. While the makeshift observatories of the astronomers were little affected, Edison had to prop his up with boards from a nearby lumberyard. According to Edwin Fox, who was there as a reporter for the *New York Herald,* "Edison's difficulty seemed to increase as the precious moment of total eclipse drew near." But finally, about a minute from total eclipse, "he succeeded in concentrating the light from the corona upon the small opening of the instrument."[3] Unfortunately, the scale of the galvanometer was inadequate to accurately measure the coronal radiance. Nonetheless, he told reporters that he was satisfied with the success of his observations and hoped to use the tasimeter to measure stars that were not visible through a telescope.

Accompanied by Barker, Edison traveled for free with passes given him by the railroad companies. Edison later recounted how Jay Gould, who controlled the Union Pacific,

> gave me a letter to the various superintendents requesting that I be permitted to ride on the cow catcher of the locomotive at my own risk— In those days the schedule time was very slow, being only 20 miles per hour. The different engineers gave me a small cushion and every day I rode in this manner from Omaha to the Sacramento Valley, except through the snow shed on the summit of the Sierra, without dust or anything to obstruct the view— only once was I in danger when the locomotive struck an animal about the size of a small cub bear, which I think was a badger. This animal struck the front of the locomotive just under the headlight with great violence and was then thrown off by the rebound. I was sitting to one side grasping the angle brace so no harm was done.[4]

After arriving in California, Edison spent three days in San Francisco, where he was offered the hospitality of the Union Club. He then rode to the top of Glacier Point in Yosemite and stayed at the Mariposa Big Tree Hotel on the other side of the mountain. Next he traveled to Virginia City, Nevada, where he was a guest of the Washoe Club. While in Nevada he visited the Consolidated Virginia mine in the Comstock lode, where he suggested that it would be possible to detect ores electrically. On his return through the Rocky Mountains, Edison went on a fishing trip in the wilderness during which he pondered the possibility of transmitting electricity from the Platte River to provide power for a mine located miles away in the mountains. Edison had bought fishing gear and a Winchester rifle in Laramie City, Wyoming, and he also went hunting with "Professor Barker, professor of physics of the

Map of Edison's western trip in the summer of 1878, showing his principal stops and the railroad route from Chicago to San Francisco.



University of Pennsylvania, Major Thornburg, several soldiers and a number of railroad officials . . . about 100 miles south of the railiroad in the Ute Indian country."[5] At each stop he met the local telegraph operators, some of whom he had known during his own operating days. Edison apparently enjoyed his vacation and the outdoor life; reporters who visited him at Menlo Park after his return commented on how well rested and tanned he looked.[6]

Before returning home, Edison traveled to Chicago to see George Bliss and then to St. Louis for the annual meeting of the American Association for the Advancement of Science. Edison was formally presented as a new member by Barker on the morning of 23 August, and it was announced that he had received the Grand Prize of the Paris Universal Exposition. In the afternoon Edison was scheduled to present four papers: "On the Use of the Tasimeter for Measuring the Heat of the Stars and the Sun's Corona," "On the Application of the Carbon Button as the Principle Involved in the Microphone," "The Carbon Telephone," and "A New Voltameter." However, he "could only be induced to read one of his papers,—the first one mentioned. Prof. Barker read the other three for him, and a good deal of discussion followed all of them."[7]

Because of her pregnancy, Mary had not accompanied her husband. Stockton Griffin reported in one of his letters keeping Edison abreast of matters at home, "Mrs E's health is not of the best— She is extremely nervous and frets a great deal about you, and about everything." Taking Griffin's advice, she visited friends on Long Island. However, this seems not to have improved her health, and on 16 August he wired Edison, "I advise your coming home at once on account of Mrs Edisons health."[8] Edison replied that he was going to St. Louis and would start for home on the 23rd; he reached home on the 26th.

While Edison was gone, Batchelor had continued to experiment with several recently made devices. He tested and improved the Partrick & Carter telephones, the Pool & Company phonographs, and the quadruplex rheostat. After Edison's trip, they returned to work on the sonorous voltameter. Patrick Kenny also began working in earnest on a facsimile telegraph during July and apparently produced the first working instrument by mid-September.[9]

Besides these ongoing projects, Edison returned from his trip filled with "projects to be worked up for future inventions." He and his staff were soon experimenting on some of these, including an improvement for duplex telegraphy, resonant tuning forks for telephones, and a chimneyless kerosene lamp. Spurred by his discussions with Barker, who "told him of some experiments he had seen at William Wallace's place at Ansonia, Ct. & wanted him to go up there & see them,"[10] Edison also renewed his experiments in electric lighting.

While Edison was gone, Edward Johnson had begun to market a more expensive phonograph with brass fittings for the Edison Speaking Phonograph Company. He and Batchelor also continued to make improvements to the exhibition phonograph, and following Edison's return, they incorporated these changes into a new, standard design that was announced in the pages of the *New York Daily Graphic.* Sigmund Bergmann began to manufacture the new design and Johnson prepared to exhibit it in New York.

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1. In addition to Edison, the group evidently included scientists Henry Draper, Henry Morton, and George Barker, Mrs. Draper, and reporter Edwin Fox. The photograph of the group at Rawlins also shows several guests: astronomer James Watson from the University of Michigan and his wife, who were based at a nearby site along the railroad; British pioneer astrophysicist Joseph Norman Lockyer; British writer William Fraser Rae; D. H. Talbot, a prosperous land dealer on vacation; Robert Galbraith, the master mechanic of the Union Pacific Railroad's locomotive works; a Mr. Bloomfield, otherwise unidentified; and a Mr. Meyers—possibly John Meier, member of an expedition at another nearby site. Frost 1969, 65; *BDAS,* sv. "Watson, James Craig"; Lockyer 1878; "The Sun's Eclipse," *New York Herald,* 29 July 1878, and "With the Astronomers," W. Fraser Rae, *New York Daily Tribune,* 13 Aug. 1878, both Cat. 1240, items 799, 819 (*TAEM* 94:303, 317); Rae to Edison, 11 Oct. 1878, Talbot to Edison, 14 Oct. 1878, and Galbraith to Edison, 6 March 1882, all DF (*TAEM* 16:217, 235; 63:233); "Total Eclipse of the Sun," *New York Daily Tribune,* 27 July 1878, Cat. 1240, item 798 (*TAEM* 94:302).

2. "Edison's Latest Inventions," *New York Daily Graphic,* 19 July 1878, Cat. 1240, item 774 (*TAEM* 94:285).

3. "The Eclipse," *New York Herald,* 30 July 1878, Cat. 1240, item 801 (*TAEM* 94:305). Edison's account of the eclipse is found in Doc. 1401 and App. 1.A1–3.

4. App. 1.A5.

5. Bill of Louis Miller to Ed. Dickinson, 20 July 1878, DF (*TAEM* 17:287); App. 1.A4.

6. Docs. 1393 n. 2 and 1395 n. 1; Washoe Club invitation, 9 Aug. 1878, DF (*TAEM* 15:1046); "Edison's Trip and Inventions," *New York Daily Graphic,* 28 Aug. 1878; "Four Hours with Edison," *New York Sun,* 29 Aug. 1878, Cat. 1240, items 858–59 (*TAEM* 94:338–39).

7. "The Scientists," *Chicago Tribune,* 24 Aug. 1878, 3.

8. Docs. 1394 and 1402.

9. See Doc. 1388 n. 6

10. App. 2.

-1370-

To Theodore Puskas

MENLO PARK, N.J.[a] July 3d 1878

Dear Sir

It may be of interest for you to know that the English provisional protection on the New phonograph patent was filed April 24th 1878 and is numbered 1644. That for France was filed June 7th 1878. For Belgium June 8th 1878. The others I have not heard from.

Parties left here for Australia via England Saturday June 15th.

I ship you this day some telephones via London.[1] I think you can get them into France as samples. They are far better than anything which Adams has had, in loudness, and clearness.

I am having a[b] great controversy with Hughes in which I shall assuredly beat him— The trickery or stupidity, either or both, of Preece is beyond all precedent. You will see by the Tribune of 27th inst[2] that Sir Wm Thomson after having seen the Microphone at Hughes' house in London has pronounced the principle identical with mine and also identical in many details. I wish you would show the matter up.

Professors Angot and André the French observers of transit of Mercury[3] who are now in Paris passed a day at my laboratory.

Please pay to Adams some money— I notice by his letters to Mr Batchelor that he does not like to ask you for it, and I have not got a great supply of this needful commodity as I have gone very extensively into experimenting of late on many new and important inventions—[4] I hope to be able to send you something startling in a short time— I hope to send you a perfect hand phonograph which runs so even that singing is beautiful and you will be astonished at the results from a machine turned by hand.

I think it will be better even than the clock work of Stroh which must give trembling to sounds.[5] The new machine reproduces music backwards beautifully and the talking is loud and clear— Please let me hear from you occasionally Very Truly

T. A. Edison G[riffin]

L, HuBPo, TP. Written by Stockton Griffin. [a]Place from Edison's laboratory handstamp. [b]Interlined above.

1. The same day Edison wrote George Gouraud that he was sending a box containing seven other boxes, the largest one of which was for Puskas. The others were addressed to *La Nature* and Count Theodore du Moncel in Paris, the *Telegraphic Journal and Electrical Review* and the *Journal of the Society of Telegraph Engineers* in London, and "Industrielle Belge" in Brussels, presumably the journal *Moniteur Industriel Belge.* Charles Batchelor wrote James Adams on 4 July asking him to see that the boxes for Puskas, du Moncel, and *La Nature* were delivered. He indicated that the box for Puskas contained "2 new Transmitters (very loud) one box of 22 carbon buttons, one box (small) of carbon silks It also contains one pressure relay with bottle full of carbon, one key and one sounder." The other two boxes contained "electrotypes of our heat measurer" (the tasimeter). These boxes as well as those to the English journals may also have contained other material supporting Edison's claims to the microphone. Lbk. 3:311 (*TAEM* 28:754); Cat. 1238:286, Batchelor (*TAEM* 93:206).

2. Doc. 1367.

3. Messrs. Angot and C. André, members of the French expedition to observe the transit at Ogden, Utah, had visited Menlo Park on 4 June. "Notes," *Nature,* 17 (1877–78): 370; Batchelor's memorandum, DF (*TAEM* 15:750).

4. In a 4 July letter Batchelor told Adams, "Edison said that he would send word to Puskas to have him hand you $150—& charge to his account I dont know whether he has already done so but if he has not I will see that he does tomorrow." Cat. 1238:286, Batchelor (*TAEM* 93:206).

5. Edison may have been reacting to William Preece's comments during his demonstration of Stroh's clockwork phonograph before the Society of Arts in London. Speaking of Edison's hand-cranked phonograph, Preece noted, "you cannot ensure the same velocity of rotation in the cylinder when the sounds are repeated as it had when the sounds were given to it. It requires great delicacy, and a great deal of experience to rotate an instrument of the kind with uniform velocity by the hand, although aided by a fly-wheel." Turning to Stroh's phonograph, he remarked that while "essentially the same in principle," it was

> an exceedingly pretty contrivance, there is a falling weight, which, by an endless chain, and two or three wheels, imparts rotation to

> the cylinder, and it has this governor above it, these expanding wings, which, by their resistance to the air, give to the instrument what it wants, namely, uniform velocity. The result is, that when you speak into this instrument, you obtain very nearly a reproduction of the sounds emitted—very nearly, not quite. The instrument has not quite reached that perfection when the tones of a Patti, or the speeches of a Gladstone, or the sermons of a Liddon, can be faithfully repeated; in fact, to some extent it is a burlesque or parody of the human voice. [Preece 1878b, 537]

-1371-

Notebook Entry: Elevated Railroad Noise Investigation[1]

July 3rd 1878

Elevated Railway noise

~~In~~1 We find that every joint is made directly on the cross tie

2 We find that in riding inside the car there is there is more noise where there are upright side rails to the road and a great number of cross girders—

3 We find that in most places when the cars go over, the rails sink about ½ inch showing the rails to be lifted up by heat or otherwise.

4 We find that the lattice girders some of which are weighted in middle act as reeds and continue the vibration for a long time after the train has passed

5 We find that the part between Chambers St and Grand St is wide (very) with heavy spans far apart.

6 We find that the diagonal cross rods vibrate strongly

7 We find that nearly all the rails butt together leaving no room for expansion although that might be with the excessive heat today.

8 We find that trains run slower (a little) do not make so much noise perhaps it would be better to stop and start quicker and run slower

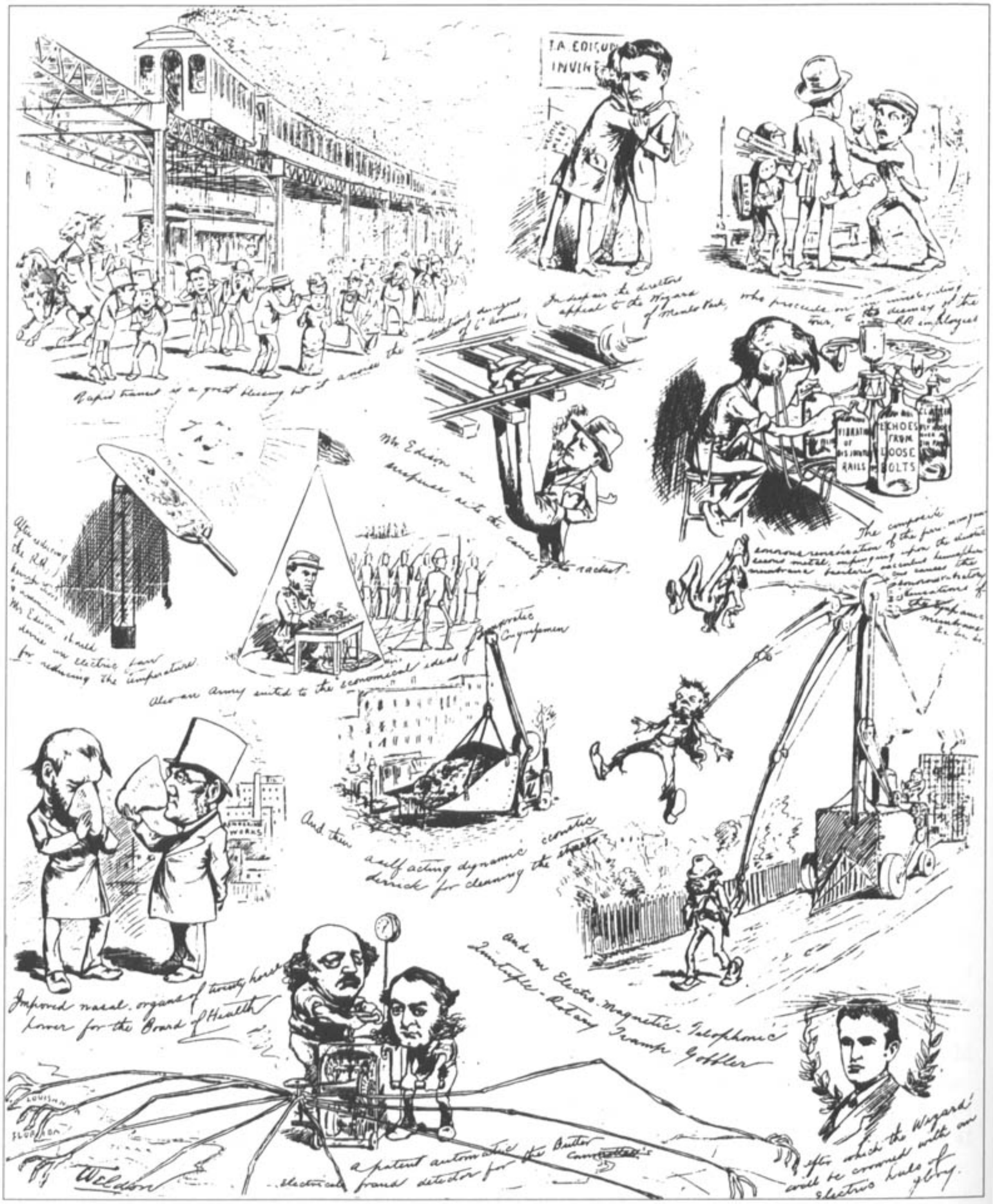
9 We find that most of the noise is due to the hammering on the rail joints by the trucks.

Edison and Batchelor 10 hours each[2]

Chas Batchelor

X, NjWOE, Lab., Cat. 30,101 (*TAEM* 6:741). Written by Batchelor.

1. The Metropolitan Elevated Railroad began operating in June above New York's Sixth Avenue. It quickly aroused complaints about excessive noise, which led to a grand jury investigation in early July and a threatened lawsuit by the Metropolitan Life Insurance Co. Grosvenor Lowrey, the railroad's attorney, arranged on 1 July for Edison to investigate the sources of noise along the line. Klein 1986, 283; "Noisy Rapid


T.A. EDISON INVENTOR
Rapid transit is a great blessing but it is among the undoubted dangers of L roads,
In despair the directors appeal to the Wizard of Menlo Park,
who proceeds on a tour, to the dismay of the RR employees
Mr Edison in suspense as to the cause of the racket.
VIBRATION OF DISJOINTED RAILS
ECHOES FROM LOOSE BOLTS
The composite
After reducing the RR
Mr Edison should devise an electric fan for reducing the temperature
Also an army suited to the economical ideas of Democratic Congressmen
WORKS
And then a self acting dynamic cometic derrick for cleaning the streets
Improved nasal organs of twenty horse power for the Board of Health
And an Electro-Magnetic-Telephonic Quintuple-Rotary Tramp Gobbler
LOUISIANA
FLORIDA
Weldon
a patent automatic electrical fraud detector for the Butler Committee's
after which the Wizard will be crowned with an electric halo of glory

The New York Daily Graphic *presented a cartoon view of Edison's investigation of the elevated railroad's noise and of further civic challenges he should master to earn an "electric halo of glory."*

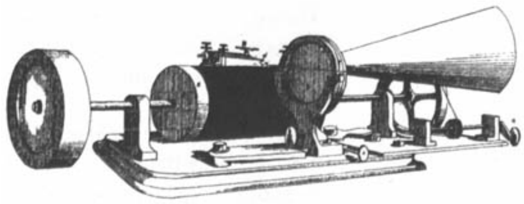
Transit," *New York Herald*, 3 July 1878; "The Sixth Avenue Noises," 14 July 1878, Cat. 1240, items 726, 769, Batchelor (*TAEM* 94:254, 281); TAE to Lowrey and Lowrey to TAE, both 1 July 1878, DF (*TAEM* 15:877–78).

On 2 July, Metropolitan Elevated's chairman wrote a pass allowing "Mr. Charles Batchelor on all trains of this Company, up or down, as he goes on the business of the Company" during July (Cat. 1240, item 809, Batchelor [*TAEM* 94:312]; presumably he provided a similar pass, not found, for Edison). On the same day, Edison and Batchelor rode the trains and listened from various points on the ground to the cars passing overhead. For several days during the next week they rode trains, walked the tracks and climbed the Elevated's trestlework. New York dailies reported these highly visible activities and published some of Edison's preliminary findings. "Efforts to Prevent Annoyance," *New York Daily Tribune*, 3 July 1878; "Noisy Rapid Transit," *New York Herald*, 4 July 1878; "Local Miscellany," ibid., 6 July 1878; "Abating the Noise," ibid., 7 July 1878; "The Metropolitan Elevated," ibid., 11 July 1878; "Rapid Transit's Clatter," *New York Daily Graphic*, 9 July 1878; "Mr. Edison and the Metropolitan Railroad," ibid., 10 July 1878; "Edisonia," ibid., 13 July 1878; "The Sixth Avenue Noises," *New York Sun*, 14 July 1878, Cat. 1240, items 720, 726, 728, 733, 736, 748–49, 752, 769, 780, Batchelor (*TAEM* 94:251, 254–55, 257, 267–68, 281, 289).

2. On 5 July, Edison and Batchelor again spent ten hours investigating the noise problem and found "that there is a sound produced by trucks on ends of rail Also sound produced by wheel passing over every tie as it is much more solid on ties than between and the difference makes noise then again can also be noticed a knock peculiar to the wheel passing over every cross beam these all help to make the roar." Cat. 30,101, Lab. (*TAEM* 6:742).

During early July the Menlo Park laboratory modified Léon Scott's phonautograph for the Metropolitan noise tests (see Cat. 30,101 and NS-78-007, both Lab. [*TAEM* 6:745–47, 7:877]; Read and Welch 1976, 3–6), using it to make a visual, permanent record of sound vibrations ("The Sixth Avenue Noises," *New York Sun*, 14 July 1878, Cat. 1240, item 769, Batchelor [*TAEM* 94:281]). Edison described his modified phonoautograph to a reporter for the *New York Daily Graphic:*

> There is a funnel which gathers all the sounds and conveys them into a diaphragm connecting with a movable straw resting across the orifice. In the end of this straw is a stiff bristle which moves over the face of a cylinder turned by a crank. The cylinder is covered with pearl-glazed paper, and underneath it is a tin box of camphor, which, on being set on fire, covers the paper with a fine coating of lampblack. The funnel collects all the air sounds which, passing through the diaphragm, move the straw, and the bristle makes the record on the lampblack coating of the paper. It traces just such a mark as all pencil [points] do on automatic heat, steam or water registers. To tell at exactly what point the greatest sounds occur, the person who uses it taps a needle point with a fixed spring upon the upper side of the cylinder. He taps at regular intervals, such as the striking of joints or any other time interval which he desires to have synchronous, with the noise recorded, and the



Edison's phonautograph for studying noise on the elevated railroad.

point shows upon the carbonized sheet the relations of the sound to the time or to the point passed. Then the carbon is fixed upon the sheet by a coating of collodion, and you have a permanent record which cannot be contradicted. It is automatic. ["Rapid Transit's Clatter," 9 July 1878, Cat. 1240, item 752, Batchelor (*TAEM* 94:268)]

On 10 July, Edison and Batchelor calibrated the phonautograph and conducted tests on the Pennsylvania Railroad "for the purpose of analogy" ("The Sixth Avenue Noises," *New York Sun,* 14 July 1878, Cat. 1240, item 769, Batchelor [*TAEM* 94:281]). Three pieces of carbonized paper from these tests are in Cat. 30,101, Lab. (*TAEM* 6:751–53). That evening they used the phonautograph on the Metropolitan Elevated to record the noise produced by trains at different points under varying conditions ("The Metropolitan Elevated," *New York Herald,* 11 July 1878, Cat. 1240, item 736, Batchelor [*TAEM* 94:268]). Batchelor conducted another series of tests between 14 and 20 August (Cat. 30,101, Lab. [6:754–55]; see also Doc. 1446).

-1372-

To E. W. Kellogg[1]

[Menlo Park,] July 4th [187]8

Dear Sir,

Phonograph Your favor of the 2d[2] was duly [recd?][a] and contents noted. I am having [a?][a] number of standard [~~telephones~~?][a] phonographs made which will be superior to any which have been manufactured— They will be first class workmanship and complete in [every?][b] respect— I will let you have 1[-][b] of them at One hundred dollars [$100?][b] each for shipment to China and Japan

Telephone I am also having manufactured a quantity of Telephones— I will furnish them to you in lots of twenty at Thirty five dollars each ($\$35^{00}/_{100}$) This price is for the instruments necessary for one station. I have the rights for the Carbon principle in all foreign countries where patents [are?][a] obtainable— The Bell telephone is sold in Europe at Seventy five dollars ($\$75^{00}/_{100}$) for each station. This will give you an idea as to what profit you can ad[d?][a] I have first class ~~firms~~ parties[c] representing and upholding my interest in Europe and all infringements of the Carbon pri[nciple?][a] will be litigated in the most short and decisive manner— Col. Geo. E. Gouraud No 6 Lombard St London is my agent for Gt Britain— Theo Puskas represents my European interests—his address is care of Col Geo. L. Beetle No 9 Rue de la [Paix?][a] Paris. The Hughes Microphone (so-called) is not an articulating telephone— He has simply discovered, and blazoned forth, that which I worked fully eighteen months to get rid of in order to make the Carbon Telephone a success— I will give you and Mr R. M. Brown[3] the exclusive right to represent my Telephone interest in China and Japan and will not knowingly sell instruments of that descripton for export to those countries, providing you purchase them in lots of twenty or more, and providing also that you take an active interest in the business, and use every reasonable means, to insure success— I have a number of applications for this territory and had the telephone been in the shape it is at present, six months ago, it would now be found on the Chinese and Japanese market.

No doubt other telephones will be introduced in those countries but the undoubted superiority in loudness, and simplicity of the Carbon Telephone will push the others out if it is handled in the proper manner— If we conclude arrangements[4] I will give you full details as regards the Construction of Telephone circuits;[5] An expert in telegraph will not be necessary in putting [up?][a] telephones and telephone circuits Very Truly

T. A. Edison G[riffin]

L (letterpress copy), NjWOE, Lbk. 3:312 (*TAEM* 28:755). Written by Stockton Griffin. [a]Faint copy. [b]Copy damaged. [c]Interlined above.

1. Little is known of E. W. Kellogg apart from his correspondence with Edison. He was in the business of "introducing American novelties both in China & Japan." These apparently included products of the Sharp Rifle Co., Gibbs & Sterrett Manufacturing Co., National Bank Note Co., and Pratt & Whitney Co. Kellogg first wrote Edison about introducing the phonograph in these countries on 10 April, at which time Edison told him to write again in two months. He renewed his request in a letter of 13 May. There is no further extant correspondence until Kellogg's letter of 2 July, but they may well have met in the interim. Kellogg to TAE, 10 and 13 Apr., 13 May, 2 July 1878, all DF (*TAEM* 15:489, 522, 654, 884).

2. Edison's letter responds directly to several questions Kellogg asked in his letter of 2 July. DF (*TAEM* 15:884).

3. Nothing is known of Brown apart from his affiliation with Kellogg. According to Kellogg, Brown was based in Shanghai and Yokohama. Kellogg to TAE, 16 July 1878, DF (*TAEM* 15:940).

4. On 16 July, Kellogg replied to Edison indicating that he was in favor of his proposal but had to correspond with Brown before making

a formal arrangement. He wrote again on 9 August, while Edison was away in the West, asking for Edison's best terms and, after explaining the heavy expenses involved in promoting American products in China and Japan, requesting liberal terms such as those they had received from other manufacturers. Edison made no arrangement with Kellogg and Brown. DF (*TAEM* 15:940, 1044).

5. See Doc. 1390.

-1373-

James Adams to Charles Batchelor

Paris July 5, 1878

Dear Sir

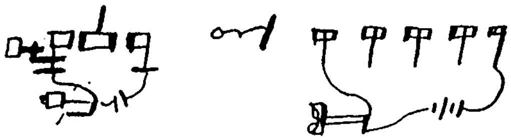
Had another comparative test to day between ours and the bell. Col Gouraud was here and he thought like every one else that there was no comparison whatever. Bell has no show. I have got ¼ of a mile of underground wire to lay to morrow and then we will have 5 miles underground and 13 Pole line right from the space in the Exhibition, we try no short circuit tests and anyone that wants too try their telephones with ours have got to try them on that wire. Bailey wont come up too [tune?][a] with the Gray but I have no doubt I will get him to try it some of those days. The receivers as you have them works all right on an air line— They are no good on an underground. got to have a stronger magnet and larger diaphragm. the magnet is either not large enough or you use poor steel—out of all the receivers that has come over only four of them has fair magnetism, the first ones that Puskas brought over and three off mine. there is no more magnetism in them than there is in soft Iron— now if you have come to the conclusion as to the standard shape of the telephone send sample over so that Puskas can start to manufacture—it is time they were on the market— send me about 200 carbons. Phonograph draws such a crowd that the break down everything—get inside the space—on top of the Tables and everywhere—so we can only show it once and cover them up until the crowd gets away so as to give some one else a chance. Col Gouraud told me that you had sent him Telephones he is going to Telegraph me as soon as they arrive— He wont do anything with them till I come over and Puskas wont let me go till he has got fairly started manufacturing and gets a man to understand all about them—so I think that I can go to London when the Telephones arrives and come back to Paris again— Microphone business is red hot There is no scientific man here but what sees and says that it is a direct infringement on Edisons Carbon Telephone— I have written a paper that I want to be read before the Academy of Sciences on wednesday night—[1] I am given to understand that Preeces is going to make me prove what I have said about him regarding the Hughes matter— I have told nothing but the truth and I am able to stand it—

I saw Edmonds the other day he has since gone back to London. If you have not sent me any money do so as I will need it in London. going to try the Telephones between Paris and Bordeux 400 miles. Puskus has applied for the wire, but we have got no answer from the department yet— give Ellen my kindest love tell her that I am well Kindest respect to Rosa & you. remember me to all yours as ever

Jim

There was a ~~man~~ frenchman came to me to day with a new microphone and wanted to try it on my wire— he would not let me see the inside nor would he tell me what principle it worked on enough to say that the diaphragm was two feet in diameter and it did not work. he thought it was very strange that it did not talk good as he had sung to it 4 ft away and it was heard all right

ALS, NjWOE, DF (*TAEM* 15:891). [a]Illegible.



James Adams showed these drawings of Edison's microphone experiments to Count Du Moncel.

1. Adams wrote on 6 July that he had met with Count Du Moncel "about reading a paper that I had prepared for the academy of Science but he says that the[y] wont enter into any quarrels. I gave Du Moncel drawings of experiments with Carbon as far back as I could remember—he says that if you will send over proof of what I have given him, or any legal papers such as copy of caveats or patents—he will take the thing up and see that you get Justice he says that this drawing will Kill Hughes alone." Adams urged Batchelor to "send all the proffs you can and he will have cuts made and have everything published in full. Du Moncell stick up for you in every way" (DF [*TAEM* 15:896]). Nothing further is known of this episode. However, the next year Du Moncel made it clear in *The Telephone, the Microphone, and the Phonograph* that he thought Edison's accusation was unfortunate and unfounded (Du Moncel 1974, 1438–45).

-1374-

Draft to the Editor of Chemical News

Menlo Park, N.J., July 8th—1878[1a]

Editor Chemical News

Allow me to state that the telephonic repeater described by Messrs Houston & Thomson in your issue of June 21[2] was invented by me over a year ago and ~~The~~ one of the many[b] forms devised by me was published in the "Journal of the Telegraph" July 15 1877,[3] and the Telegraphic Journal of London about the same time.[4] M

T A Edison

ADfS, NjWOE, DF (*TAEM* 17:139). Letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted. [b]"of the many" interlined above.

1. This letter was published in the 26 July issue of *Chemical News* (38:45).

2. Edwin Houston and Elihu Thomson, science teachers at Central High School in Philadelphia, had presented their findings to the American Philosophical Society on 3 May and published accounts in the *Journal of the Franklin Institute, Nature,* and the *English Mechanic* (Carlson 1991, 78). Edison was responding here to their 6 June letter to *Chemical News* (37:255). Edison also responded indirectly to Houston's letter in the course of a telephone conversation with Henry Bentley that was transcribed and published in the 26 June issue of the *Philadelphia Times* ("A Telephonic Interview," Cat. 1240, item 719, Batchelor [*TAEM* 94:251]). Houston responded to Edison in a letter of 22 August, which was published in the 13 September issue (38:138–39) and led to Edison's reply of 29 September (Doc. 1460).

3. This was actually in the 1 June issue (Doc. 926).

4. This had appeared in the 1 July 1877 issue of the London-based *Telegraphic Journal and Electrical Review* (5:149).

-1375-

Draft to the Editor of Engineering

Menlo Park, N.J., [July 8,] 187[8][a]

Engineering

Your compiler of Telephone article has given credit to Hughes for ~~just~~ exactly what he suppressed [~~in my own paper sent you~~?][b] from[c] article sent you.[1]

Edison

ADfS (telegram), NjWOE, DF (*TAEM* 15:902). Letterhead of T. A. Edison. [a]"Menlo Park" and "187" preprinted; date from docket on back. [b]Illegible. [c]Interlined above.

1. Edison's protest concerned the article, "Edison's Carbon Telephone," in the 21 June issue of *Engineering* (Cat. 1029:166, Scraps. [*TAEM* 25:249]). Edison articulated his complaints in Doc. 1378. Also on 8 July, Edison wrote a formal letter to the editors of *Engineering* that they published in the 26 July issue above a strong defense of the original article ("Edison's Carbon Telephone," Cat. 1032:37, Scraps. [*TAEM* 27:834]).

-1376-

From George Gouraud

London—E.C.[a] 9 July 78

To T. A. Edison Esq.[b]

Phono Am just retd from Paris & only time to say O. K. & add that got well acquainted with Puskas who wants me to act for him re. Phonograph in England and has made an agreement to give me ¼ of his share of[c] rects. from Exhibition of Phono. if I will succeed in making Nottage divide—[1] I must have also Power from you before I can act with proper discretion & effect. So please fwd it imm[ediatel]y[2] also say if you will also give me same share of your proportion viz ¼ of? Thats fair, as you may get nothing but I think I can manage him—

That is of Exhibition rects. only— Dont lose any time.

GEG

ALS, NjWOE, DF (*TAEM* 19:276). Express note form of George Gouraud; note form is electric pen copy. [a]"London—E.C." preprinted. [b]"To T. A. Edison Esq." preprinted. [c]"share of" interlined above.

1. That is, separate control of phonograph sales from phonograph exhibitions.

2. Gouraud wrote again the same day to acknowledge receipt of the power of attorney (Doc. 1365). DF (*TAEM* 15:909).

-1377-

Anonymous Article in the Scientific American

New York, July [10?], 1878[1a]

PROFESSOR EDISON'S NEW CARBON RHEOSTAT.[2]

In quadruplex telegraphy it is vital to the working of the system to perfectly balance the electrical current.

The common method of doing this is to employ a rheostat containing a great length of resistance wire, more or less of which may be thrown into or cut out of the electrical circuit by inserting or withdrawing plugs or keys. This operation often requires thirty minutes or more of time that is or might be very valuable.

To remedy this difficulty Mr. Edison has devised the instrument represented in the engraving, Fig. 1 being a perspective view and Fig. 2 a vertical section.

Fig. 1.

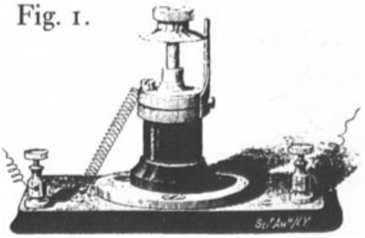
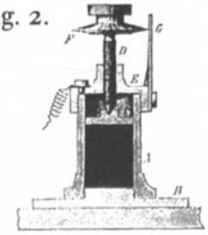


Fig. 2.



A hollow vulcanite cylinder, A, is screwed on a boss on the brass plate, B. Fifty disks—cut from a piece of silk that has been saturated with sizing and well filled with fine plumbago and dried—are placed upon the boss of the plate, B, and are surmounted by a plate, C, having a central conical cavity in its upper surface. A pointed screw, D, passes through the cap, E, at the top of the cylinder, A, and projects into the conical cavity in the plate, C. The screw is provided with a disk, F, having a knife edge periphery which extends to the scale, G, and serves as an index to show the degree of compression to which the silk disks are subjected.[3]

The instrument is placed in the circuit by connecting the cap, E, with one end of the battery wire and the plate, B, with the other end.

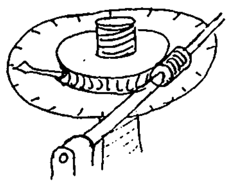
The principle of the instrument is identical with that of Mr. Edison's carbon telephone. The compression of the series of disks increases conductivity; a diminution of pressure increases the resistance. Any degree of resistance within the scope of the instrument may be had by turning the screw one way or the other.

In this instrument the resistance may be varied from 400 to 6,000 ohms, and any amount of resistance may be had by increasing the number of silk disks.

PD, *Sci. Am.*, 39 (1878): 35. In Cat. 1240, item 763, Batchelor (*TAEM* 94:277). [a]Date not that of publication.

1. *Scientific American* usually appeared about 10 days before the date of publication; this appeared in the 20 July issue.

2. Laboratory time sheets for George Jackson and John Kruesi show work on the "Quadruplex Rheostat" on 10 and 11 June respectively, and an account book entry for this instrument begins on 14 June. The next entry is on 26 July, suggesting that this instrument was finished in June. DF (*TAEM* 17:625); Cat. 1185:206, Accts. (*TAEM* 22:649).



Charles Batchelor's drawing of a micrometer adjustment for the carbon rheostat.

3. Apparently this adjustment was not sufficiently sensitive and on 27 July, Batchelor asked Kruesi to "make one carbon-silk resistance box like first made, but with scale on side." Kruesi finished this instrument on 8 August and Batchelor experimented with it on 15 August. At that time he noted that "to make a resistance box of carbon silks to work from 1000 to 10 000 ohms it is necessary to put on a micrometer attachment as the best dead lift I can get is only 3/32 of an inch." The following day, an account book entry was begun for the "Quad Reostat New Style." NS-78-003, Lab. (*TAEM* 7:72, 780); Cat. 1317:65, Batchelor (*TAEM* 90:689); Cat. 1185:267, Accts. (*TAEM* 22:675).

-1378-

Menlo Park, N.J., U.S.A., July 11, 1878[a]

To the Editor of the English Mechanic

MR. EDISON'S REPLY.

I[b] HOPE you will be able to afford space * for the publication of my reply to the telegram of Messrs. Preece and Hughes, printed in your issue of June 28. The reply is printed in the *New York Tribune* of June 27, 1878.[1] I notice an article in the same number headed "Who Invented the Microphone?" Allow me to state that the writer has evidently obtained the technical information from *Engineering,* to whom, at my request, Mr. Prescott sent proofs and cuts of that portion of his work on telephony descriptive of my carbon telephone.[2] The article as published in that journal has been mutilated, and credit is given Prof. Hughes for exactly what has been suppressed from the proofs sent. Your article, however, contains one short sentence, which did not appear in *Engineering,* which nullifies one of the distinctive claims of Prof. Hughes. I quote:—"The inflexible plate of course merely serves, in consequence of its comparatively large area, to concentrate a considerable portion of the sonorous waves upon the small carbon disc. A much greater degree of pressure for any given effort on the part of the speaker is thus brought to bear on the disc than could be obtained *if only its small surface alone were used.*"

Beneath this sentence the writer says:—"Let it be remembered that in the microphone there is really no diaphragm at all, and it is clear that Mr. Edison has written under a misapprehension, for his inflexible plate is, to all intents and purposes, a diaphragm."

The words that I have italicised surely mean, if they mean anything, that I did just what Mr. Hughes claims as a distinctive feature—*i.e.,* talk directly against the carbon. But, finding the results improved by adding the plate to concentrate the waves upon the disc, I adopted it as a practical improvement, especially as it prevents the spittle from being absorbed in the carbon.

The following paragraph was suppressed by the writer in *Engineering.* "* * *I discovered that my principle, unlike all other acoustical devices for the transmission of speech, did not require any vibration of the diaphragm—that, in fact, *the sound waves could be transformed into electrical pulsations without the movement of any intervening mechanism.*"[3]

Again, the writer in your paper says that Mr. Hughes "went very much farther and beyond (Edison) by discovering that all conducting substances may be employed with 'equal success.'"

I quote another paragraph suppressed from *Engineering:*—"Mr. Edison has found, however, that plumbago, hyperoxide of lead, iodide of copper, powdered gas retort carbon, black oxide of manganese, amorphous phosphorus, finely divided metals, and many sulphides may be used. Indeed, tufts of fibre, coated with various metals by chemical means, and pressed into buttons, have also been employed, but they are all less sensitive than lamp-black, and have consequently been abandoned."[4]

Now, if Prof. Hughes has found any other substance not included in this list that may be used with "equal success," I should like the name of it; but, above all, I should be happy to learn for what purpose the paragraphs quoted here were suppressed by the compiler of the article in *Engineering* on my carbon telephone.

Thomas A. Edison.

*We have already referred to Mr. Edison's reply on p. 433, again mention it this week.[5]

PL, *English Mechanic,* 27 (1878): 497. In Cat. 1240, item 814, Batchelor (*TAEM* 94:314). [a]Date not that of publication. [b]Preceded by item number 14625.

1. Doc. 1367; see also "Edison and Hughes," Cat. 1240, item 699, Batchelor (*TAEM* 94:241).

2. The article "Who Invented the Microphone" appeared on p. 381. Regarding *Engineering* see Doc. 1375 n. 1. The "proofs and cuts" to which Edison referred were from Prescott 1878c.

2. See Doc. 1375 n. 1. The "proofs and cuts" to which Edison referred were from Prescott 1878c.

3. Prescott 1878c, 226. *Engineering* attributed this discovery to Hughes, who "employs no diaphragm at all, the sonorous vibrations in his apparatus acting directly upon the conducting material or through whatever solid substance to which they may be attached." The *Engineering* writer concluded that in Edison's telephone, "the diaphragm is the ruling genie of the instrument. Professor Hughes, however, has through his great discovery been enabled to show that variations of resistance can be imparted to an electrical current not only without a diaphragm, but with very much better results where no such accessory is employed." "Edison's Carbon Telephone," *Engineering,* 21 June 1878, Cat. 1029:166, Scraps. (*TAEM* 25:249).

4. Prescott 1878c, 38. *Engineering* had presented Edison's choice of carbon as the selective application of a general principle found by Hughes: "The discovery of Professor Hughes is, that all conducting substances may be employed with equal success. . . . It will thus be seen that Mr. Edison's discovery is but a special case of the larger and more comprehensive discovery of Professor Hughes." "Edison's Carbon Telephone," *Engineering,* 21 June 1878, Cat. 1029:166, Scraps. (*TAEM* 25:249).

5. This was in an editorial, "A Receiving Microphone," in the 12 July issue; see also the letter from Hughes on p. 422.

-1379-

From Norman Miller

New York July 11th, 1878.

Friend Edison,

I have been at times a good deal of a bother to you, but be patient, it will not last long.

I am glad to know—as I well do—that at other times I have been able to do you valuable service in the right manner, and at the important time and place.[1]

I wish that it[a] could have been at all times better done, and that it might have continued without break.

I wish to thank you now for your many and continued acts of kindness, and of compensation to me, and to assure you how satisfactory it is to me, as one of your oldest friends, to look forward to what I believe to be a bright and successful career of fame and prosperity that is now immediately before you—

May you live long to fill up its full measure of usefullness, and to enjoy with your family its rewards.

In connection with the thought of it, my mind always goes back to our dear dead friends, the "General" and "President,"[2] and I think how heartily they would congratulate you, were they living, and how much they would enjoy in saying—each in ~~their~~ his[a] "emphatic" way—to "the rest of mankind"—"we expected it all, and told you so." Respect to their memory, and one of their enduring monuments is ~~their~~this faith with[b] which they "backed" you "till the "wilderness was passed."

I know how pressed for time you must before leaving for Colorado, but hope that you will be able to give me the formula for "Dupl. Ink," and such instructions as may be in your mind— Also confidentially the terms on which Bliss holds it under contract, and I will make him a fair offer to take the stock off his hands, and will then "run the business" so that you will get returns.[3]

I cannot see as he ever intends to make you any—and if he declines my fair offer—after what you said to him—I will be justified in going ahead on my own account.

Since you asked me if "$15. a week would do me," on account of the $1000. that we thought ought to come out of Accoustic, etc contracts &c that finally run into Telephone, and I said "yes, make it but $10. and it will last longer" we have not "figured up" the aggregate sgiven me from time to time.

You have been exceedingly generous, and I can never forget any part of your kindness.

I hope that without fee or other reward, than the satisfaction of doing what may fall in my humble and obscure way—

that I may yet[b] be of[c] some ~~very private~~ service to you—

Now to close the entire question of compensation—or perhaps I should rather call it of generous consideration bestowed, or to be bestowed upon me I wish to ask this,—which falls short of the $1000. named above, and which shall be final.

$100. now will do me more good to carry out your good advice and intentions than twice that sum scattered[b] along.

I think that I know quite well that you cannot spare any such amount on the eve of your absence for three weeks. But what I want you to do is to let me have

say in cash	$15.
Acceptance 30 days	40.
" 60 "	45.

or 2 Acceptances of $50 each at 30 and 60 days. The latter will answer, but[b] the first will do better.

Or $10. and a single acceptance for $90. at 2 mos. if it looks easier and safer to you—[4]

My dear friend it will save a man that would have had a salary of more than that monthly from May 1st[5]—but you know why not—and will set him "going right." Truly yours

N. C. Miller

ALS, NjWOE, DF (*TAEM* 15:920). [a]Interlined above. [b]Obscured overwritten letters. [c]"be of" interlined above.

[1] For Miller's assistance to Edison see *TAEB* 1:499 n. 1, 513–14, 3:182 n. 4, 334 n. 3; Docs. 282, 284, 288, 292, 296, 303, 316, 338, 348 n. 23, 694, 695, 786, 788, 913, 993, and 1142.

[2] That is, Marshall Lefferts and William Orton.

[3] See *TAEB* 3:203, 289; Docs. 825, 831, 836, and 912.

[4] Edison gave Miller a two-month note for $80 which Miller presented to Grovesnor Lowrey and his law partner Charles Stone after it came due. They advanced Miller the money and he wrote Edison on 29 September asking him to take up the note. DF (*TAEM* 16:164).

[5] In 1873 Miller had apparently embezzled $42,066.85 (including interest on the stolen money) while serving as treasurer of Gold and Stock Telegraph Co. Miller turned his home over to the company, which paid the $9,000 mortgage while Miller continued to occupy it without paying rent. At the time Miller wrote this letter to Edison, the company was planning to eject him from the property and obtain a judgment "so that if he should ever become worth anything the debt could be collected." G&S Executive, 190.

-1380-

From George Barker

Brookfield Center Ct. July 12. [1878]

My dear Edison:

We leave New York by the Penns. R.R. on the 8:30 train Saturday[a] (tomorrow) evening. (Pacific Express) Please be on hand. Arrangements for tickets and for Pullman car all made.

Draper[1] writes me that you have got passes for us to San Franciso. Am very much obliged and think we will have a good time. Don't fail to instruct Batchelor to send to me, care J. K. Rees[2] St. Louis, a box containing your newest things, telephone, tasimeter, rheostat etc involving the carbon button, for the paper I am to prepare for you to read at the Am. Association for the Advancement of Science there the 21st of August.[3]

I shall leave here at 11 tomorrow morning and shall be at Dr. Draper's 271 Madison Ave. at 3 P.M. Yours truly

George F. Barker.

ALS, NjWOE, DF (*TAEM* 15:929). [a]Obscured overwritten letters.

[1] Edison had met Henry Draper, professor of chemistry and natural science at the University of the City of New York (now New York University), a year earlier. See Doc. 967.

[2] Probably Columbia University astronomer John Rees. *DAB,* s.v. "Rees, John Krum."

[3] Edison did not leave Chicago for St. Louis until the night of 21 August. Two days later he briefly discussed the carbon principle, but apparently only presented a formal paper on the tasimeter, which he prepared with assistance from Barker. After Edison left the meeting, Barker "presented as well as I was able the question of the microphone for you." Docs. 1401, 1404, and 1406; Barker's undated notes and Barker to TAE, 2 Sept. 1878, both DF (*TAEM* 19:432; 16:5).

-1381-

James Adams to Charles Batchelor

Paris July 12th 78

Batch.

Have at last got cable finished from our space so that I can connect to any part of france telephones work red hot. I suppose you will be thinking it is about time I know I do. Grays Telephone wont work at all Phelps does work—but not as good as the Bell telephones that Gower[1] brought from Boston. Bailey showed the Phelps telephone to some newspaper men and telegraph men but I believe it was represented as the Gray I asked Haskins[2] for a Gray to see how it would do for a receiver for ours but he said it was no use they would not work that they were all out of adjustment Showed our telephone to the American Commission today on an 18 mile wire and the most delicate whisper could be heard. It is a decided success the receivers that I use will lift their own weight That is the weight of the whole telephone The magnet I make 4 parts I only use such receiver where I have got under-ground wire to contend with I am going to get the quad on monday I will put one end up in our space ~~in~~ and[a] the other in the Country[b] office.[3] Pope tried to get it but could not.[4] I am very glad that I have got them as ~~I~~it will fill up our space nicely. We have a man for the other end of telephone that speaks 4 languages so everyone can get a chance to listen to Telephone I say how is it that you said that McLaughlin had gone to Australia I find that he is in London at the present there is something strange about it that I cant as yet see through. I read a letter from London that was not intended for me to see it ran thus "Mac is in London if there is any letters comes for him addressed to my care put them out of sight and dont breath to a living soul on earth that he is here.[c] He will very likely come to Paris with me." That letter was written by Beetle who is now in London to Doctor K——[5] I dont understand it as yet.

Adams

L (transcript), NjWOE, DF (*TAEM* 19:869). Written by Stockton Griffin. [a]Interlined above. [b]Obscured overwritten letters. [c]Overstruck quotation mark.

1. Frederic Gower, who had managed Alexander Graham Bell's telephone lectures since 1877, held the Bell Telephone Co. agency for New England outside of Boston. In 1878 he went to France on behalf of the Bell telephone, but subsequently patented his own minor variation, promoting it as the "Gower system." Bruce 1973, 227, 235, 246.

2. Charles Haskins, a friend of George Bliss's, was general superintendent of the Northwestern Telegraph Co. in Milwaukee and general agent of the Bell Telephone Co. in the Northwest. He had written Edison on 2 April asking to see him before leaving for the Paris Universal Exposition at the beginning of May. DF (*TAEM* 18:451).

3. Nothing is known of this location.

4. Cornelius Herz had refused to show the quadruplex at the Paris Exposition and Edison had asked Prescott in a 24 June letter to "write an order that I can send it to Adams and have the quadruplex placed in our space in the Exposition" (Lbk. 3:305 [*TAEM* 28:749]). Pope may have tried to circumvent this order, perhaps by attempting to make the quadruplex part of the Western Union exhibit and thereby associate it with the company's electricians rather than with Edison.

5. Dr. P. F. Kern (see Doc. 1387).

-1382-

Paper for the American Association for the Advancement of Science[1]

Menlo Park, N.J., July 13, 1878.[a]

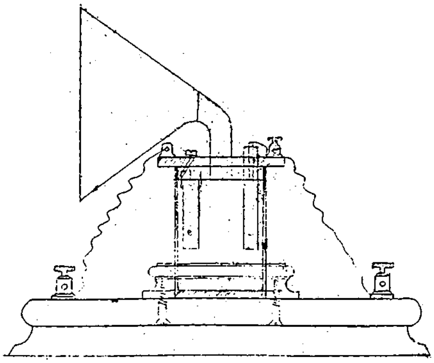
The Sonorous Voltameter

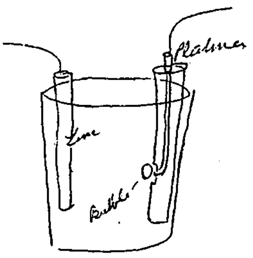
THE sonorous or bubble voltameter consists of an electrolytic cell with two electrodes, one in free contact with a standard decomposable solution and the other completely insulated by vulcanized rubber except two small apertures, one of which gives the solution free access to the insulated electrode, and the other allows the escape of bubbles of hydrogen as they are evolved by electrolysis. With a given current and a given resistance a bubble is obtained each second, which is seen at the moment of rising and which at the same time gives a sound when it reaches the air. The resistance may be reduced so as to give one bubble in one, five, ten or fifty seconds, or in as many hours. I have compared this instrument with the ordinary voltameter[2] and find it much more accurate. By the use of a very small insulated electrode and but one aperture, through which both the gas and water current must pass, great increase of resistance takes place at the moment when the bubble is forming; and just before it rises, a sounder magnet included within the battery circuit opens, closing again when the bubble escapes, thus allowing by means of a Morse register the time of each bubble to be recorded automatically.[3] This apparatus, when properly made, will be found very reliable and useful in some kinds of work, such as measuring the electro-motive force of batteries, etc. By shunting the voltameter, and using a recorder, it becomes a measurer not only of the current passing at the time, but also of that which has passed through a circuit from any source during a given interval.

THOMAS A. EDISON, Ph.D.[4]

PD, *Am. J. Sci.* 3rd ser. 16 (1878): 379–80. Preceded by "Art. XLVIII."
[a] Date not that of publication.

Edison's sonorous or bubble voltameter.





Voltameter arrangement from 29 August.

1. The editor of the *American Journal of Science* noted that this was read at the St. Louis meeting of the Association. (It was actually read by George Barker; see Docs. 1401 n. 1 and 1406 n. 6.) It was also published in 1879 in the Association's *Proceedings* of the August 1878 meeting (27:112).

2. At that time, a standard voltameter measured current strength by passing the current through dilute or pure sulfuric acid and measuring the volume of gas evolved. Prescott 1877, 157–61.

3. For a few days following Edison's return from St. Louis, he and Batchelor conducted further experiments with the voltameter and designed alternative methods of passing the gas bubbles from the electrode and amplifying their sound. NS-78-012, Lab. (*TAEM* 7:934–40).

4. On 26 June, Union College in Schenectady, N.Y., had conferred upon Edison an honorary Ph.D. Union College to TAE, 28 June 1878, Miller (*TAEM* 28:1130).

-1383-

Telegrams: To / From John Daly

July 15, 1878[a]
Menlo Park, N.J.[b]

Dr Dailey

My boy[1] very sick bowel complaint Please come quick bring medicine answer

Thos A Edison[2]
Rahway N.J.[3]

T. A. Edison

Will be there directly

J. J. Daly[4]

L (telegrams), NjWOE, DF (*TAEM* 17:571). Letterhead of T. A. Edison. [a]Date from document, form altered. [b]"Menlo Park, N.J." preprinted.

1. Thomas Alva Edison, Jr.

2. This message was probably sent by Stockton Griffin; Edison had left two days earlier for Rawlins, Wy.

3. This answering message was written at the bottom of the page containing the original message to Daly.

4. Nothing further is known of John Daly, a Rahway physician. The correct spelling of his name is uncertain, but he was listed as Daly in the 1880 census and in this telegram, the only one sent directly by him. Stockton Griffin consistently spells his name Dailey (see Docs. 1524 and 1525). U.S. Bureau of the Census 1970, roll 801.

-1384-

J. J. Dickey to Division Superintendents and Train Dispatchers, Union Pacific Railroad Co.

Omaha, Neb., July 17 1878[a]

To Div Supts & Train Dispatchers & Conductors U.P.R.R.

This will introduce Mr Edison the celebrated inventor & telegrapher—

Please permit him & members of his party to ride on the Locomotive or where else they may desire—

Mr Dillon[1] Prest bespeaks for him every courtesy of the Road and I shall especially esteem any attention you may be able to show him—[2] Very Respy

J. J. Dickey Supt Tel[3]

ALS, NjWOE, DF (*TAEM* 15:950). Letterhead of Union Pacific Railroad Co. Telegraph Department. [a]"Omaha, Neb.," and "187" preprinted.

1. Sidney Dillon had been the primary contractor for construction of the Union Pacific. He became the railroad's director and president in 1874. *DAB*, s.v. "Dillon, Sidney."

2. Dickey wired railroad operators to "Send all messages of Mr Thos A. Edison free." He also arranged for E. Dickinson, superintendent of Union Pacific's Laramie Division, to meet Edison's train in Rawlins. On 19 July, Dickinson wrote out a pass for "Thos A. Edison & party between Ft Steele & Creston good for 12 days." This is a distance of about fifty miles, near the middle of which is Rawlins. Dickey to Union Pacific operators, 17 July 1878; Dickey to TAE, 18 July 1878; E. Dickinson to Laramie Division conductors, 19 July 1878; all DF (*TAEM* 15:949, 951, 971); see also App. 1.A5.

3. A former Western Union telegrapher, J. J. Dickey became superintendent of the Union Pacific telegraph department in 1869. Taltavall 1893, 38.

-1385-

From George Gouraud

London—E.C.[a] 18 July 1878.

To T. A. Edison Esq.[b]

Preece controversy— I saw Preece at his request— He was anxious to convince me of your entire and as he expresses it, "unaccountable error" He feels greatly grieved and is confident that you will in the end see your mistake— He was anxious to convince me of his entire right in the question— I emphatically declared that I should take no sides in the question personally— I told him that you evidently felt that you had indisputable grounds for your suspicion and your charge and that you had taken measures to substantiate the same by documentary evidence which would be duly forwarded to your Counsel here— Upon this, you would stand or fall— That it would be finally no question of opinion— I sincerely trusted you would find yourself mistaken— Obviously, the result most to be hoped for— ~~i~~as, if you were right he would be damned, whereas if you were wrong, you would have only made a mistake which you could fully amend by such a retraction I felt sure you would make— He read me two letters from Hughes and one from Thomson which I thought you might like to see— Of these, he gave me the copies hereto annexed.[1] When your documentary evidence referred to comes forward—I shall place it in the hands of the best Counsel for their opinion—and if the same sustains your charge, the whole thing shall be given to the press—and that will be your vindication— I am sure this course you will approve and that you will appreciate the wisdom of my abstaining from any part in the controversy— I told Preece that there seemed some doubt as to Adams having received fair-play— He repudiated the insinuation and declared that he had no interest whatever in anybody's Telephone—nor would have—that no Telephone yet seen, Bells, Grays, or anybody's was practicable or satisfactory—that he had publicly stated his opinion that yours was the most likely to be practicable— He is "anxious to see[c] yours" and begs me to believe that every facility will be at my command in the Post office— I thanked him for this, and said I should certainly call upon him if it were necessary— I shall however have the private lines, as indicated in mine of yesterday—[2]

Megaphone— Send me everything concerning this— and one of them with least possible delay— Leave to my judgment the selection of scientists best adapted in all our interests for bringing the thing before the public— Preece has had glory enough! We'll give somebody else a turn!

Toy Phonograph— Send me one of these as soon as possible—

Inventions generally— I think we had better have an understanding with regard to my participation in the results of negotiations in your behalf applying generally to anything you may be good enough to send me— I think ~~half~~— I furnishing all the expenses of negotiation and patents &c— The fair thing would be one half— What do you say?

Telephones— You will notice in Hughes's letter re microphone controversy that he distinctly declares your receiver to be a direct infringement of Bell's patents—[3] Send me at once, everything you have to say on this subject personally, as well as everything there is to be said or has been, as shewn by printed matter— I understand that immediately we move in this matter they intend to serve an injunction upon us— So we must be fore-armed— I understand from you that the receiver is free? Give me the documentary evidence on this point.

GEG

ADDENDA[d]

London—E.C.[a] 18 July 78.[4]

Box by express referred to in yours of 3rd inst received this morning all the packages for London are delivered—[5] Mr Puskas being here, I have placed that addressed to himself in his own hands— He goes to Paris tomorrow taking it with him

GEG

"Adriatic"[6] 18 July 1878.[7]

Your Contract with Puskas— You promised to send me a copy of this— I trust you will do so without delay—as he has been spending some time with me—the result of which is my possibly joining him in his Continental business—and it may come about that I shall purchase an interest in his interests with you— It would save much trouble if I could know exactly what his Contract with you is— Apropos of this, he is very anxious to have me interested in the Nottage Contract—as he does not get on with Nottage— His recent interviews have been very unsatisfactory— He cannot get Nottage to admit that his receipts from exhibitions amount to anything— What is still more important, he cannot get him to admit your right to any share in them. In view of all this, he has made me ~~one half of his~~ a proposition to sell me one half of his interest in the Nottage Contract which I understand to be ⅓rd of all you get under that Contract— He asks me £500 for this—which is equivalent you see to ⅙th Interest— This is about half the amount you propose to charge me for a share in yours—recently named at £1000 for ⅕th— Now in view of the inducements which persuade Puskas to consider it desirable to sell me half of his interest for the amount named I submit to you that it is equally important in your interest—and I, in view of this, make you the proposition that if you will sell me the ⅕ of your interest for £500—I shall then feel disposed to accept Puskas's proposition— If you assent to this, please cable me the word "Nottage"[8] and I shall at once proceed in the matter— Puskas proposes to give me from himself the same power which you have given him as towards Nottage; but it would be altogether preferable if you accompanied it with a like power from yourself—

GEG

LS, NjWOE, DF (*TAEM* 15:952). Express note forms of George Gouraud; note form is electric pen copy. [a]"London—E.C." preprinted. [b]"To T. A. Edison Esq." preprinted. [c]Interlined above by Gouraud. [d]Addenda are LS, on express note form of George Gouraud.

1. Stockton Griffin re-copied these letters and sent them to Edison, probably on 29 July when he wired: "Send today foreign letters care Frank B Rae Telegraph Office San Francisco." Griffin to TAE, 29 July 1878, and his undated marginalia on the Thomson transcription, both DF (*TAEM* 15:1005, 962).

Thomson's 12 June letter to Preece is a response to Doc. 1347 (see n. 1). The first letter from Hughes to Preece, dated 8 April 1878, concerned early experiments with the microphone. In the second, written on 30 April, Hughes asked Preece to judge whether the microphone worked by "molecular action" or a different principle. He offered to show him "for the first time the microphone (please suggest a good name for such an instrument) by which you can hear tones or sounds too feeble to be appreciated by the ear alone. If I can catch a fly you will hear him walk over the piece of wood as a horse crossing a bridge—a peculiar tramp, peculiar to Mr Fly alone." Transcriptions of Hughes to Preece, 8 and 30 April 1878, DF (*TAEM* 15:958, 960).

2. Gouraud wrote that he had a "private wire ready connecting office with Picadilly 3 miles & will have connexion also with Liverpool, & Glasgow or Edinburgh." The date on this letter is unclear; Stockton Griffin transcribed it as 15 July. Gouraud to TAE and transcription, both DF (*TAEM* 19:872, 873).

3. In a 29 June letter to the *New York Tribune,* David Hughes wrote that "the Edison receiver was identically the same as Professor Bell's, the only difference being that the natural magnet was brought round so as to touch the diaphragm; in fact, it was so transparent a device to infringe Bell's patent that the Bell Company at once said they would not permit its use." Hughes also said of the Edison transmitter that its diaphragm consisted of the "same form and materials as Professor Bell's" and that "it was complicated, required not only the use of batteries, but induction coils, and the results were not superior to those of Professor Bell's, against which it was tried in my presence." Gouraud had probably seen a version of this letter in the 5 July issue of *Engineering,* which indicated that Hughes sent it to "the leading scientific journals of this country and the United States." Cat. 1240, items 759, 790, Batchelor (*TAEM* 94:273, 297).

4. This was apparently written initially as a separate letter but then paginated as a continuation of the preceding letter.

5. Gouraud probably meant Edison's letter of 3 July (see Doc. 1370 n. 1).

6. The *Adriatic,* a ship of the White Star line used for transatlantic passenger traffic, was the fastest ship of her ("oceanic") class at this time (Gibbs 1957, 229–35). Gouraud apparently sent this letter on that ship.

7. What follows, although separately dated and signed, is continuously paginated with the preceding.

8. No reply has been found.

-1386-

Charles Edison Memorandum: Telegraph Conversation

[Menlo Park, July 21, 1878?][1]

[illegal?][a] only one from the editor of the electrician did tribune publishe and the engineer article[2]—Ed—

G—yes—and comments were favorable— I have sent[b] you about ten letters and some papers how long are you going to stay there Mrs E wants to know—Ms

E— All right— I will be home about the 18[b] of Aug—is every thing going on right how are the new telephone—RS—

G— batch says got instr from P[artrick]&C[arter] magnets a failure have made a magnet with one quarter stock and much more magnetism than the one we snt them— have a pair working between here and depot works[b] good make them better look elegant everybody thinks they—

E ~~did u say~~ are the spools connected right g.a. every—

G[c] Batch says yes can make them all right— Shall be able to fit everybody up this week— I have made some silks[b] that test forty have got phonauto[graph] very ~~se~~ sensitive with thin stretched rubber diaph and shall take some records on Monday night if a fine night—.[3] Can u get me wall nuff to get letter fm Seabrooke—[4]

E— rall— I lay dmye

AD (fragment), NjWOE, DF (*TAEM* 15:1030). Apparently written by Charles Edison. [a]Illegible. [b]Obscured overwritten letters. [c]Interlined above.

1. This was dated 5 August in *TAEM-G1*. However, on 22 July Griffin wrote Uriah Painter, "Was talking with T.A.E. yesty had a wire from here to Rawlins" (UHP); internal evidence suggests this as a more likely date. This copy was apparently made by Charles Edison while listening to the exchange, perhaps as a form of telegraph practice. It is incomplete and throughout he seems to have had problems receiving the message, perhaps due in part to physical problems on the line as well as to his limitations as a receiver.

2. The London-based *Electrician* had reprinted Doc. 1348 in its 29 June issue ("Telephone and Microphone," Cat. 1240, item 762, Batchelor [*TAEM* 94:276]). This may be what Edison means by this reference to the *Tribune.* It is unclear to what *Engineer* article Edison is referring, but this telegraph exchange is somewhat garbled and it is possible he was asking if his letter to the editor of *Engineering* had been published (see Doc. 1375 n. 1).

3. Griffin was apparently quoting Batchelor. There is no evidence of Batchelor's taking records of the elevated railroad noise on Monday, 22 July (see Doc. 1388).

4. George Seabrooke taught astronomy at Rugby, England (MacLeod and Friday 1972, s.v. "Seabrooke, G. M."). The 30 May issue of *Nature* (18:129) had carried a letter by him regarding his experiments

with the microphone and Edison had sent him copies of publications related to the controversy over this device. On 6 July, Seabrooke thanked Edison for sending these articles, expressed himself as "glad my letter in Nature has been appreciated," and stated that he was not clear on how Hughes's principle differed from Edison's. Griffin sent a copy of Seabrooke's letter to Edison, who, after his return, wrote on the original: "See Prescotts book   fully set forth where I use finely divided metals" (DF [*TAEM* 15:900]).

-1387-

James Adams to Charles Batchelor

Paris July 22d 78

Batch.

I am going to give you a letter today one everything   I tell you it is red hot here   I could tell you good deal more [~~that~~?] than[a] what I want to write but what I do write you may repeat to anyone unless I say different. I guess you know that the foreign pen business has gone to hell—and that something has got to be done as soon as possible, for I tell you that there is money in it and plenty of it, If it is conducted right. Beetle has been in London now for nearly 3 weeks and so is ~~mac~~Mac and by what I learn they have had a red hot time. Saw two letters that came from Beetle yesterday   I will give you the substance of them but first let me tell you that Beetle does everything to hurt Edison that he possibly can   when he first come to Paris he did not want to put Edisons name to the pen at all as he said that he was not an honest man   I heard that before but only from persons employed by Beetle but when strangers and outside people ask me if I know Edison and when I say yes, know him as well as I do myself, what kind of a man is he and when I tell them they say it is strange there is Beetle representing an invention of his and he says that he is not an honest man and cant be trusted in any business[b] matters   I have not had that from one but many   now ~~b~~Beetle comes home tonight   I shall make him deny it flatly before some of those people or make him repeat it again and if he does in my presence I will send him home short of some of his front teeth   He is Gray and no one[b] else. I dont know what Beetle statement is but I have it from Kern there has been sold 260 outfits at an average price of 35 dollars per outfit besides extra's[1] those pens have been sold without any effort on the part of any one, one agent is all that he has got in the whole of Europe   I can give you the correct figures in a day or two as Doctor Kern has made all the sales that have been made he has entered them up for his own benefit   It is evident that Beetle has got to cave in soon and it is necessary that there should be no interruption in the business for if it once gets into the press that it has fell through the public will believe it is a failure— Letter from B to Dr K—"You post me to fullest extent. I met Frank Pope today and learn that Bailey is here and that Puskas will be here today. You evidently strive to keep me in the dark or else you are extremely ignorant of what is going on around you I believe the former is the fact— I hope you got through the [—~~t~~][c] rent matter today & that sales is good. Sell 20 or 25 outfits if possible even if you only get 25 dollars for No 2 and 30 for No 3 ~~A~~I want the money for a particular purpose. I shall reduce expenses on my return in every possible way and unless this matter goes off here I shall close up the pen business within the next 3 months What about Italy? Dont stand on the number of outfits I shall call on Puskas I know his address I shall see him and H (Hickling?)[d] at 6 oclock this evening and it is possible that I can change the programme but I question my ability to do so. H is a New York broker and you know that they cant be fooled one interview with Nottage was enough to open his eyes to the fact that the whole thing was being killed and there was no money for him in the enterprise."

Beetle.

"P.S. Keep down expenses and I will tell you something interesting when I come back. Beetle[e]

I dont know if Mac will come to Paris or not I hope he will as I would like to get to the bottom of it as I am completely in the dark as to Mac being in London[2] Tried some telephone experiments today with Count du Moncel and wife showed that the tick of a watch could be heard distinctly and other delicate sounds if you can send proofs over he will have them published and bring them before the Academie of Science there is one thing that he still hampers upon, that is, that Krantz[3] discovered ~~that~~ that carbon increased and decreased its resistance by pressure in 1873 He used powdered Carbon in glass tubes ~~and~~any one would know that any powdered conductor would decrease itself resistance by being brought closer together I showed him the telephone the other day he was very much pleased with it but as he did not mention anything about his discovery I did not to him. Count du Moncel will show the principle of the electromotograph at the next meeting I presented him with a very nice hand motograph yesterday Doctor Kern & Herman Pothe[4] is the man that wants to get the pen business Pothe is secy for Puskas he can get the money to make it go or at least has got it ready now. I have advised them to write to you direct If Bliss would give it up they would rather give Edison an extra royalty than[b] have any to pay to Bliss. Beetle[b] may try to put it[b] into the hands of Roosevelt if it does[b] it goes into as bad hands as it is now. He has got a large stock of Bell Telephones and not one of them will work he has ordered 2,000 watch telephones.[5] Gower has come here and condemned them all. Roosevelt wont take them but the manufacturer has forced him to take them as he had made them as ordered and did not care whether they would work or not— Between you and me Roosevelt is nothing but a gambler and runs this telephone to make believe that he is a business man This is for only you and Edison to know only or rather for no one else to know that it came through me.

Adams

⟨How do you like this letter? S.L.G.⟩[f]

L (copy), NjWOE, DF (*TAEM* 15:979). Written by Stockton Griffin. [a]Interlined above. [b]Obscured overwritten letters. [c]Canceled. [d]Interlined several lines above at top of page. [e]Followed by centered horizontal line. [f]Written by Griffin.

1. A statement from Beetle showing foreign pen sales between September 1877 and August 1878 indicates that a total of 168 outfits plus supplies and attachments had been sold. DF (*TAEM* 18:337).

2. Since Frank MacLaughlin returned to the United States by 2 August it is unlikely he visited Paris or met with Adams. Doc. 1392.

3. Unidentified; but du Moncel may actually have referred to M. Clérac (see Doc. 1398).

4. Dr. P. F. Kern and Herman Rothe wrote Edison from Paris on 18 July about acquiring the electric-pen agency for the Continent. Kern stated that he was "thoroughly familiar with the instrument and knows how business has been transacted and what changes are necessary." Their letter gave no further information about either, except to say that both were "foreigners" and would have "the facility of being able to treat with 6 different nationalities in their own languages." DF (*TAEM* 18:305).

5. Unidentified.

-1388-

From Charles Batchelor

Menlo Park, N.J., July 24th 1878[a]

Thomas A. Edison.[1b]

Saw Walker today, he is anxious. He took me to some carbon telephones of Phelps make, one working to 23rd St and another to Brooklyn—everything could be got perfectly. I told him I would bring over something a great deal better tomorrow. I am going to put a pair on their worst wire tomorrow I think it will astonish them. I have had a great deal trouble with P&C's insts no mag[netis]m in magnet am making new ones all through.[c]

Paid your insurance today[c]

Guess I've got Murray an order from Walker if he will make cheap enough[c]

I have taken no records of M.E.R.R.[2] yet machine is ready but have had no time owing to telephones troubles.[c]

Dont give yourself any uneasiness as I have got the trouble by the nuts and I shall yet get rid of them all by next Monday.[c]

Should like to Answer this controversy about microphone receiver but wait to see what you think.[3c]

Have sent tasimeter patterns and a first rate new drawing to W.E. Mfg Co[4c]

Am getting along nicely with the press and die for Jim but cannot send it with the telephones[c]

Phelps edition of carbon telephone is good as it is exceedingly cheap, of course not so loud as ours I shall go and see him about that and shall also insist on Edison Carbon telephone being put on all of them.[c]

Man writes today for 20 carbon tels. from California, referred to Walker.[c]

Charley sends Photo of P&C telephones today[5c]

Am paying Kinney $12 per week but he does not work here but at home is that to your satisfaction.[6c]

Cheever has busted higher than a kite[7] but Painter and Hubbard were closeted this afternoon & I understood that they had secured everything so that it will be no inconvenience. You will probably have more reliable information on this from them[c]

They say you have busted their business by giving them away to some Chicago reporter.[8c]

Advise me about Jim's letters I am ready primed only waiting to know what you wish to do.[9c]

Am making 2 Megaphones and shall try them in two weeks at Watch Hill[10c] Yours phonographicarbontelephonically

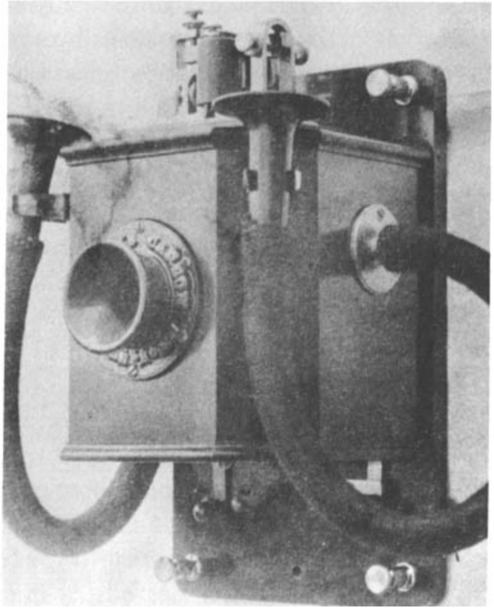
Batch!!![d]

What did you think of translations I sent of Phono. being put in class of telegraphic Insts (did it! didnt they?)[11c]

Is it right for Scientific to ~~ad~~ print instructions on how to make a phono. and give dimensions etc without telling them that by making from them they infringe B[12]

ALS, NjWOE, DF (*TAEM* 15:985). Letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted. [b]Underlined twice. [c]Followed by centered horizontal line. [d]"Batch" underlined twice.

1. This was addressed to Edison at Rawlins, Wy.
2. That is, recordings of noise on the Metropolitan Elevated Railroad (see Doc. 1371).
3. See Doc. 1385 n. 3.
4. On Tuesday, 16 July, Batchelor wired Western Electric: "Tasimeter patterns sent today instructions by mail Thursday." DF (*TAEM* 19:425).
5. A copy of this photograph is in Cat. 76.015:6, NjWOE.



A telephone made for Edison by Partrick & Carter in 1878.

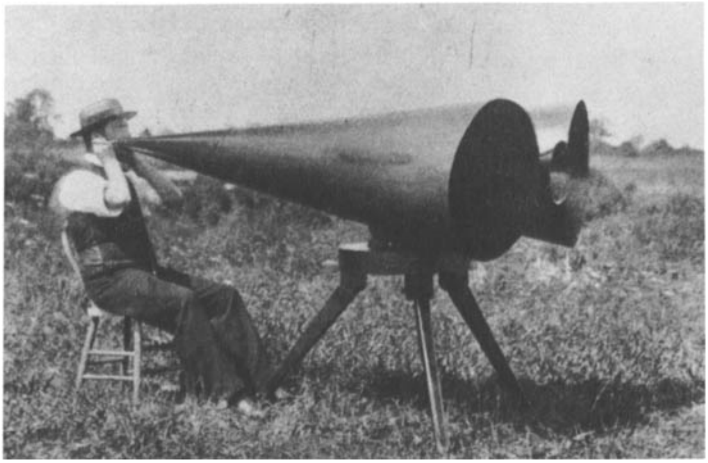
6. On 16 July, Patrick Kenny had written Batchelor about providing twelve dollars per week for his work on facsimile (autographic) telegraphy and indicated that Norman Miller would come out to see him regarding it. Miller noted on Kenny's letter that Batchelor gave him twelve dollars for Kenny on 17 July (DF [*TAEM* 19:533]). Kenny's July and August payments are recorded in Cat. 1185:249, Accts. (*TAEM* 22:667). By the last week of December he appears to have begun working at Menlo Park (Kenny's time sheet, DF [*TAEM* 17:870]; Ledger #3:359, Accts. [*TAEM* 87:156]). A series of experimental autographic test strips that probably dates from mid-September is found in Cat. 1032:118, Scraps. (*TAEM* 27:912).
7. Charles Cheever had apparently invested in the New York Belting and Packing Co., of which his brother John was treasurer and co-owner. On 24 July, John Cheever notified creditors of the company and of a related Boston concern of the firms' inability to meet their obligations. "Mr. Tappan's Failure," *New York Daily Tribune,* and "Tappans Defalca-

tion," *New York Daily Sun,* both 25 July 1878, Cat. 1240, items 781–82, Batchelor (*TAEM* 94:291–92).

8. Nothing is known of what Edison said, but it may have been similar to the remarks discussed in Doc. 1419 n. 1.

9. This may refer to Doc. 1387, which Griffin copied and sent Edison.

10. Watch Hill is a coastal town in extreme southwestern Rhode Island, where Uriah Painter had been staying during July. On 8 July, Painter wrote Edison that he had poles to run a wire down the beach near Watch Hill, from where an "old sea capt" had assured him it would be possible to talk over the sound of the waves. Painter presumably thought of using the megaphone to communicate from land to ships at sea and then transmit the information by telegraph. On 18 July, Batchelor wrote to Painter: "Have you decided whether you will make a trial of megaphone at Watch Hill yet. For such trial I ought to make a pair of wrought iron ones that will stand solid in a wind. If you still intend to make the test I will have them made." On 22 July, Griffin informed Painter that it would take two weeks to complete the iron megaphone; a measured drawing of the device was made on 27 July. Batchelor initially intended to ship the megaphone to Painter on 9 August but did not send it for another week. He apparently went to Watch Hill to conduct tests of the megaphone during the third week of August. After Edison's return, Painter asked him to come to Watch Hill for "one or two days to direct further tests" as "it needs some troubles overcome." An August photograph shows Batchelor using the megaphone (Cat. 76.015:5, NjWOE). Painter to TAE, 8 July and 30 Aug. 1878, DF (*TAEM* 15:907, 1102); Batchelor to Painter, 18 July, 5 and 15 Aug. 1878, and Griffin to Painter, 22 July 1878, all UHP; NS-78-002, Lab. (*TAEM* 7:771–72).



Charles Batchelor using the megaphone.

11. On 17 July, Batchelor had sent translations of articles that appeared in the 3 July *Le Figaro* and 4 July *Le Petit Moniteur Universell* (DF [*TAEM* 15:942]). The articles described a demonstration before the Universal Exposition's jury for telegraphic instruments on 3 July. Ac-

cording to these news accounts, messages were recorded on an Edison clockwork phonograph in Paris, then replayed into an Edison carbon transmitter on a line to Versailles. Herman Rothe also sent messages from Versailles to Paris, where Puskas recorded them by placing the telephone receiver against the phonograph mouthpiece. Jury members witnessed the exchange at both Paris and Versailles. In a 7 July letter to Adams, Batchelor asked for more details after reading a report of the tests in that day's *New York Tribune* (Cat. 1238:288, Lbk. [*TAEM* 93:208]). Brief accounts of the tests also appeared in the *Engineer* of 2 August and an unidentified English-language journal (Cat. 1032:31, 43, Scraps. [*TAEM* 27:831, 840]).

According to *Le Petit Moniteur Universell,* members of the telegraphic jury afterwards debated whether the phonograph should be judged with precision instruments or with telegraphs, finally deciding on the latter. According to a report in the 3 September *New York Tribune,* however, the jury held it "of no use whatever in telegraphy" and refused to consider it for a prize (Cat. 1032:88, Scraps. [*TAEM* 27:870]). This prompted Theodore Puskas to write to Andrew White, the honorary U.S. commissioner and a member of the appeals jury, to ask the panel to reconsider (2 Aug. 1878, ADW; *NCAB,* s.v. "White, Andrew Dickson"). Puskas told White that Count du Moncel, a precision instrument judge, had promised him that the phonograph was "entitled to the highest reward" in telegraphy. Despite this effort the phonograph did not receive an award, though Edison was given a Grand Prize (see Doc. 1405). (In his *Autobiography,* White recalled that Puskas had neglected to exhibit the phonograph to the committee, being too occupied showing it for a fee [White 1905, 1:514]).

12. The 20 July *Scientific American Supplement* (6:2112–13) carried instructions on "How to Build a Working Phonograph," which included half-scale drawings. The unsigned article began: "Now that Edison has invented the Phonograph, it is easy enough to make one, and every one wonders that it had not been done before. The Phonograph, truly wonderful as it is, is exceedingly simple and may be made at a slight expense." The 27 July issue of *Scientific American* (39:60), which would have been available around the 16th, printed a letter from a reader giving further instructions. The day after Batchelor wrote Edison, Stockton Griffin wired him: "Painter and others attach great importance to Scientific Americans Phonograph Article and drawings ignoring fact of its being patented. Suggest asking Munn withdraw invitations to public to infringe and say infringers be prosecuted. Unless this is done your royalty swallowed in litigation." Orson Munn was an editor of *Scientific American* (*DAB,* s.v. "Munn, Orson Desaix"). Cat. 1030:30, 34, Scraps. (*TAEM* 25:272, 274); Griffin to TAE, 25 July 1878, Painter to TAE, n.d., both DF (*TAEM* 19:100–1).

Edward Johnson wrote Uriah Painter on 25 July that he wanted to send a letter to *Scientific American* but would wait for Edison's reply (UHP). On 29 July, he again wrote Painter stating that he had talked with a representative of the journal about the matter, and asked permission to place an ad in the next issue warning that Edison's phonograph was protected by a patent (UHP). Johnson also prepared a circular, dated 1 August, specifying Edison's patent and the civil penalties for making, selling, or using an unauthorized phonograph (Cat. 1241, item 884, Batchelor [*TAEM* 94:353]).

Despite these protests, *Scientific American* published additional drawings and instructions on 24 August (39:18). An editorial in the 31 August issue (39:128) defended the phonograph articles as within the law governing scientific experimentation and in accord with "the wish of the inventor, as expressed to us, in helping to give the widest pubicity to his invention." "A Simple Phonograph," Cat. 1240, item 832, Batchelor (*TAEM* 94:327); "The Rights of Investigators," Cat. 1032:35, Scraps. (*TAEM* 27:833).

-1389-

From Charles Batchelor

Menlo Park, N.J. July 276th, 1878[a]

Dear Sir,

The telephones in the first, had no magnetism in them I have made new ones and get exceedingly loud talking clear and can be heard 15 ft away.[1] Notwithstanding this, when I put them on Brooklyn wire five miles to Scott's house which is the worst wire in the country it worked well, but not so well as the small Phelps receiver the difficulty being its resonant qualities being so great that i[t][b] appeared muffled I did not try any other wire as I know it is OK for any other wire but such a one as 23rd St or Scotts wire which runs on poles in N.Y. with 72 others, cable, & then 40 wires on poles for 4[c] miles. If there was any noise in room I do not think that the Phelps would be so good.

I left them there and took over another pair today with smaller diaphragms 1⅞ in[ch] clear of ferrotype plate[2] and although the diaphs were 2½ hundredths away from core the magnets were so strong that they were very loud still there is such a resonant tone to them that Scott likes the Edison Phelps better I expected to get Murray an order but I must demonstrate to them that this form will work better even on that line than the other. I think it advisable not to send Jims or Gourauds until we have worked the Brooklyn wire better than the Edison Phelps inst. does which is poor to say the best although they seem perfectly satisfied with it.[3] We have got so much loudness that I am putting in some heavier diaphragms for experiment.[4] I know if you were here you would far prefer ours because the Phelps rec. would be too low for you, but I must satisfy them on that wire and then I think we can safely send them to Europe I shall put up McKenzie's and also send Smith's of Central America and two to Mexico[5] & hope to write you shortly of success of Brooklyn wire—

I went to see Cheever about your telegram today and he said that he presumed you meant the balance on $10,000. I told him that I presumed it was. He said there was due from him about $600 and from Painter $100 which was balance of $10,000 He said that he was restrained from paying anything and that you would be obliged to wait 3 weeks or a month and he was sure you would do that knowing the trouble he was in. He said that he thought Painter must have wired you to do this but told me not to say so as he did not know but he might be mistaken.[6] He told me that he had sold out ~~in~~ telephone to Hubbard & was going[c] out of it.[7] Will see Painter tomorrow & see if there is any chance of getting it out of ~~him~~ Cheever.

Everything is going lovely except that the telephones not going right off to my satisfaction Keeps us at it night and day instead of doing other experimenting I shall send 350 carbon buttons to Chicago Monday or Tuesday Yours as ever

Batchelor

ALS, NjWOE, DF (*TAEM* 15:998). Letterhead of Edison's laboratory. [a]"Menlo Park, N.J." and "187" preprinted. [b]Written off edge of page. [c]Obscured overwritten letter.

1. On 24 July, Batchelor had instructed John Kruesi to "Make new magnets for Partrick and Carter telephones." Vol. 18:5, Lab. (*TAEM* 4:1049).

2. That is, a receiver diaphragm made of ferrotype plate, 1⅞ diameter of which was visible or "clear."

3. A month earlier, L. A. Ludwig had written Edison that T. J. Smith, who had established a demonstration telephone line across the Isthmus of Panama, had "found Phelps telephones in use there—to a very small extent—and in experimenting found the Phelps receiver in Combination with your transmitter to give much better results than your set complete." Ludwig to TAE, 28 June, DF (*TAEM* 19:865).

4. On 26 July, Batchelor experimented with telephone receiver magnets. He also experimented around this time with tin and iron receiver diaphragms of varying diameters and thicknesses. On 28 July, Griffin wired Edison: "Just tested telephone with Phila Loudest and best talking we ever had but of course a little more induction owing to size of diaphragm." Vol. 15:27, 150, Lab. (*TAEM* 4:353, 455); DF (*TAEM* 19:739).

5. See Doc. 1394 n. 5.

6. This money was due Edison under the 30 January phonograph contract (Doc. 1190). Edison's telegram has not been found, but Cheever's supposition was correct. On 25 July, Painter telegraphed Batchelor, "Wire Edison I want him to send you msg requesting you to call and get balance of the ten." The same day Batchelor wired Edison,

"Cheever has failed." Griffin also telegraphed Edison on 25 July, "I strongly advise attending to Painters request of this morning." DF (*TAEM* 19:100, 880).

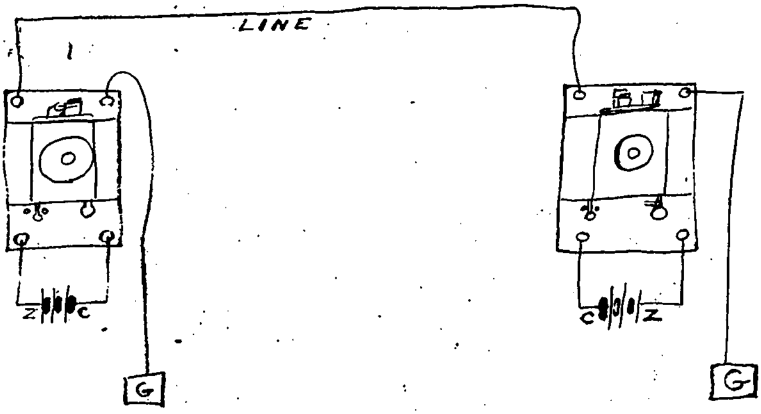
7. The buyout was proposed in April and the sale was finalized on 30 July. Tosiello 1979, 219–21.

-1390-

Instructions for Setting Up Telephones

[Menlo Park,] July 30 78

Instructions for setting up No. 1 & 2 telephones[1][a]



Leave switch on left hand side button and call by pressing the key a number of times

After getting an answer on sounder switch over to the right hand button and talk in transmitter with ear tubes place[d][b] to the ears

After you have finished talking be sure to switch back on to the left button.

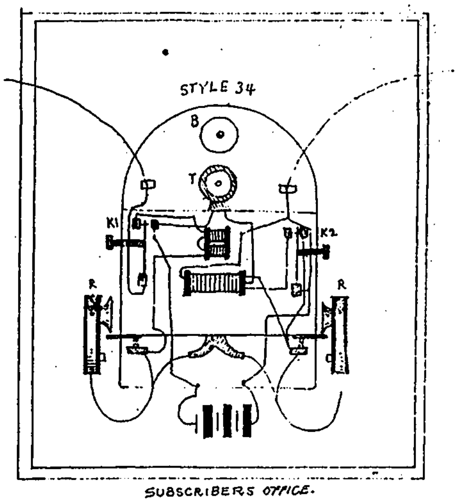
Use three cells callaud on each end of line over 5[c] five miles. Use 4[c] four cells at each end if line over 10[c] ten miles. But if only very short line 2[c] two cells callaud is sufficient

Thos A Edison per Batchelor

D (letterpress copy), NjWOE, Lbk. 3:325 (*TAEM* 28:766). Written by Charles Batchelor. [a]Followed by centered horizontal double line. [b]Faint copy. [c]Circled.

1. These instructions were probably drawn up for foreign users of Edison's telephone sets (see Doc. 1372). In the United States, his telephone was controlled by Gold and Stock Telegraph Co., which established a central-district exchange system. A set of drawings showing various arrangements used in the New York exchange is found in Cat. 1240, item 671, Batchelor (*TAEM* 94:274); also see descriptions in DF (*TAEM* 52:165). One of these drawings shows the circuit arrangement

Circuit arrangement of Edison's carbon telephone as used by Gold and Stock customers.



of a subscriber's telephone. **B** is the bell, which is operated by the magnet (two coils) under the transmitter, **T**, and above the induction coil. The two earphone receivers are labeled **R**. The battery is at bottom. When the switches K1 (left) and K2 (right) are out the telephone is ready for operation and can be called from the district office. To call the district office, the user would push K1 in and out rapidly, which puts the local battery intermittently on the line and provides sufficient power to work the office bell or sounder. The right switch would then be pushed in to talk and listen. The subscribers would be connected by the switchboard (the wire at upper left) at the district office.

-1391-

Charles Batchelor to James Adams

[Menlo Park,] July 31st [187]8

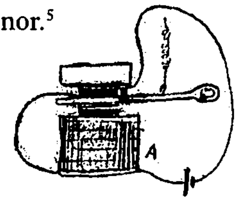
Dear Jim,

Microphone[a] = I send you a few papers which may help you

Copy of document of carbon receiver— Tracing of three more important documents. fix up the reading matter to suit yourself you cannot be beat on these although the dates are 77 instead of 76. Dont let Bleye[1] get ahead of us on microphone receiver I had it mentioned in Prescotts new book now coming out.[2] Did you get his book I sent you?[3][b]

Telephone[c] I have got some good telephones but they have a little resonance owing to us using eartubes and having two diaphragms in a box and am afraid they might not suit your underground lines I have written Edison to see whether I should send them. If he says so I will but you must be the judge of them as to their working Send you Photograph of one.[4] I cannot send you Gourauds yet till I hear from him.[b]

Electrical Governor.[5]



A Spool
B Carbon button

The current runs as you see through both carbon button[d] and the spool as the battery weakens it has less magnetism and consequently presses ~~less~~ more[e] on the carbon and makes resistance correspondingly less. You may of course have another button insulated from the other under pressure which can regulate a second circuit[b]

Foreign Pen I expected just as you have said in regard to the Pen. I have tried to raise some money for myself and Ellen from Bliss several times but all to no purpose, he has got so now that he dont answer my letters Shall write to him and have him correspond with you.

Your letter on the Count's wife is laughable[6b]

Sir Wm Tom~~p~~son wrote Preece & told him that Edison deserves the first place in the microphone business and that he Preece explained the thing at Plymouth when he showed Edisons telephone (This confidential)[f]

Pope I see Pope is home here today.[b]

W.U. Contract Our contract with W.U. Tel Co is all OK we have drawn since June 1st Ellen is getting your share; dont fear; I'll look out for her![b]

McLaughlin Mac' started for Australia with Phonograph but went to England with the gentleman that is with him in order to try and sell Australia there first. If they sell there he will not go If they dont sell they will go.[7b]

Laboratory About as usual. Martin[8] & G. Carman, and boy[9] as help, Will Carman keeping books and tracing our experiments, Griffin writing letters etc Kruesi, Jackson,[10] Logan,[11] Sigal[12] Albert[13] Charley[14] Eckstrom[15] in shop.[16]

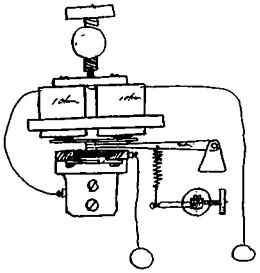
This Photo[17] is one of our first taken[d] on our new photo apparatus[18] Yours truly

Chas Batchelor

ALS (letterpress copy), NjWOE, Batchelor, Cat. 1330:11 (*TAEM* 93:225). [a]Paragraph headings in left margin, most with flourishes. [b]Followed by centered horizontal line. [c]Repeated at top of next page. [d]Obscured overwritten letters. [e]Interlined above. [f]Paragraph enclosed by braces and followed by horizontal line.

1. In his letter to Batchelor of 6 July, Adams had stated that the use of the carbon transmitter as a receiver "is claimed by one Bleye who says that he discovered it 15 days ago, send proofs of that if possible." Nothing further is known of Bleye. DF (*TAEM* 15:896).

2. Though Prescott expected a new edition of his book, *The Telephone and the Phonograph,* to appear in 1878, it was not published until the following year, retitled *The Speaking Telephone, Electric Light, and other Recent Electrical Inventions.* That edition consisted of the original thirteen chapters plus three additional ones, including "Edison's Recent Telephonic and Acoustic Inventions," which contained a discussion of the microphone (Prescott 1879, 534–44). Prescott to TAE, 19 June 1878, DF (*TAEM* 97:678).



Edison's drawing of an "Automatic Current regulator with magnet and carbons."

3. That is, the first edition of *The Telephone and the Phonograph.* On 25 June, Prescott had written Edison that he had "sent the twenty books yesterday, as you requested." DF (*TAEM* 18:843).

4. See Doc. 1388 n. 5.

5. It is unclear for what purpose Edison and Batchelor thought this device might be useful. Edison's drawing of a slightly different arrangement, dated 21 June, is found in NS-78-011, Lab. (*TAEM* 7:921).

6. Letter not found; person unidentified.

7. See Doc. 1328 n. 6.

8. Martin Force.

9. This is probably Theo Whitney, whose name first appears in time sheets for the week ending 28 June. He replaced Alex Craig, Jr., who was discharged in mid-June. At the time of this letter he was doing general work in the laboratory, pressing carbons, and helping with the photography. Alex Craig, Sr., to Batchelor, 19 June 1878, and time sheets, all DF (*TAEM* 17:493, 623, 634, 661).

10. Machinist George Jackson may have worked briefly for Edison and Murray in January 1875. He originally turned down a job at the Menlo Park laboratory in December 1877, but reapplied in March and was working there by June. During the week Batchelor wrote this letter Jackson was working on telephones and the quadruplex rheostat. PN-75-00-00.2, Accts. (*TAEM* 22:337, 339); Jackson to TAE, 20 Dec. 1877 and 11 Mar. 1878, and time sheets, all DF (*TAEM* 14:439; 17:469, 625, 658).

11. Although Jehl (1937–41, 2:680) claims that Thomas Logan (d. 1887) had begun working as a machinist at Menlo Park sometime in 1877, the first evidence of his being at the laboratory is a time sheet from the first week of June 1878. At this time he was working on telephones and making the mold for carbon buttons. Time sheets, DF (*TAEM* 17:625, 659).

12. John Sigel had answered Edison's advertisement for machinists in the 6 January *New York Sun.* At the time he was working at Alex Pool's Newark shop making burglar alarms and electric indicators. Sigel described himself as a toolmaker of twelve years experience in the leading watch factories as well as an inventor of a "Damescening Machine for Nikel Movements." Sigel was working at the laboratory by June, though he was no longer employed by the beginning of September. It is unknown if Batchelor's notation on Sigel's January letter that he was "No good . . . too old" was written before or after he worked for Edison.

At the end of July he was working on a press to mold carbon buttons and on telephones. Sigel to TAE, 6 Jan. and 15 Sept. 1878, and time sheets, all DF (*TAEM* 17:458; 16:52; 17:626, 660, 691).

13. It is unclear to whom Batchelor is referring. The only Albert known to be working at the laboratory at this time was Albert Eckstrom (see note 15). He may have meant Alfred Swanson, whom Jehl (1937–41, 1:128) describes as the night watchman. Swanson had begun working for Edison in December 1876 and by the time of this letter was running the steam engine and helping in the machine shop. Cat. 1213:7, Accts. (*TAEM* 20:8); time sheet, DF (*TAEM* 17:660).

14. Edison's nephew Charles Edison.

15. Machinist Albert Ekstrom had worked for Murray & Co. in 1874 and may have been the "Albert" listed in a January 1875 labor account. He was employed in the Menlo Park laboratory by June 1878 and at the time of Batchelor's letter was working on telephones, phonographs, and the megaphone. After working for another week on the clockwork phonograph, he and Kruesi had a misunderstanding and he stopped working at the laboratory, though he applied for work again a month later. Ekstrom to Edison & Murray, 5 Dec. 1874, Scraps. (*TAEM* 27:512); PN-75-00-00.2, Accts. (*TAEM* 22:338); Ekstrom to TAE, 9 Oct. 1878, and time sheets, all DF (*TAEM* 17:509, 623, 656, 664).

16. Time sheets indicate that at this time patternmaker Milo Andrus and machinists Charles Flammer and John Hood were also working in the laboratory (DF [*TAEM* 17:654, 656–57]); for biographical information see Jehl 1937–41, 222, 320, 546, 682, 688.

17. Not found.

18. Edison had acquired this apparatus at the beginning of June (William Trotter to TAE, 4 June 1878, DF [*TAEM* 15:745]). Photographic prints from the summer of 1878 were made onto postcards, a set of which was pasted into a photograph album that can be found at the Edison National Historic Site (Cat. 76.015).

-1392-

From Stockton Griffin

Menlo Park Aug 2d 78

Friend Al

I send herewith a document of some interest to you.[1] McL[aughlin] has been here today is very much disappointed at not finding you here. Is loaded down with foreign news some of it d——dly interesting to you. I asked him to write you fully and he said he would do so tonight—[2]

He says Adams is representing himself as the inventor of the Carbon telephone, and as your partner &c&c. It seems to me, (and Batch has[a] expressed himself as of the same mind) that Adams is, to say the least, overdoing the matter— It galls me to read Count du Moncel speaking of Mr[a] Adams as "your colleague"[3] Aren't you afraid he may do you incalculable, and irreparable injury?

I am sending you everything of importance, you may think I am sending too much but I consult Batch and send what we both deem most interesting. I have Brewer & Jensen's opinion on your Eng patent No 2909.[4] It is very long or I would copy it & transmit to you Prof B says you are getting fat and I am glad to hear it— Your folks all well— Yrs &c

S.L.G.

ALS, NjWOE, DF (*TAEM* 15:1026). [a]Obscured overwritten letter.

1. Not found.
2. Not found.
3. The source of this quotation is not known.
4. Brewer & Jensen prepared for Vallance & Vallance a twenty-three page opinion on the sustainability of Edison's British telephone patent. They examined each claim in Edison's final specification against both those of his provisional specification and Alexander Graham Bell's British patent. Brewer & Jensen concluded that "at least thirteen of the claims and a few points in the body of the specification should be altered by Disclaimer and memorandum of alteration in order to render the Patent so valid as will probably make it good in law if ever attached." The suggested changes included striking at least six claims that either were not made in the provisional filing or appeared to conflict with Bell's patent. Brewer & Jensen to Vallance & Vallance, 4 July 1878, Miller (*TAEM* 28:1131).

-1393-

George Ladd to James Fair[1]

San Francisco, Aug 2 1878[2a]

My dear Sir:

I take great pleasure in introducing Prof Thos. A. Edison, the distinguished inventor, who is anxious to visit the mines.[3]

I shall be greatly obliged if you will extend to him the opportunity of doing so, under favorable circumstances, and he may possibly reciprocate your courtesy by inventing some apparatus which will not only divine the location of hidden bonanzas, but also estimate their extent and value with all the mathematical precision of a professional mining expert.[4]

With Kind regards, Truly Yours,

Geo. S. Ladd[5]

ALS, NjWOE, DF (*TAEM* 15:1024). Letterhead of Gold and Stock Telegraph Co. of California. [a]"San Francisco," and "187" preprinted.

1. James Fair was one of four partners in the so-called Bonanza firm which dominated mining and banking in Virginia City, Nev., at this time. In 1871, Fair and his partners acquired land rights held by the Consolidated-Virginia Co. and developed what became known as the

"Big Bonanza" of Comstock Lode gold and silver deposits. The firm also organized the Nevada Bank of San Francisco. The Big Bonanza was largely exhausted by the end of 1877; Fair withdrew from the partnership in 1881, the same year the Nevada legislature elected him to the U.S. Senate. Elliott 1973, 132–34, 164–66; Hulse 1978, 108–9.

2. The previous day, the Union Club of San Francisco, at Ladd's request, had offered Edison the privileges of its Club House for fifteen days. Union Club to TAE, 1 Aug. 1878, DF (*TAEM* 15:1020).

3. The same day, Ladd also sent a letter of introduction to W. H. Smith, whom he asked to show Edison "the mines and other lions of Virginia." The *New York Sun* later reported that Edison spent one day in Virginia City and visited the Bonanza firm's Consolidated-Virginia Mine. Ladd to Smith, 2 Aug. 1878, DF (*TAEM* 15:1023); "Four Hours With Edison," *New York Sun*, 29 Aug. 1878, Cat. 1240, item 859, Batchelor (*TAEM* 94:339).

4. In 1875, Edison first considered using electricity to detect and determine the extent of ore deposits (see Doc. 650); he thought again about this possibility after his visit to Nevada. On his return to Menlo Park, Edison talked with reporters about how miners could map the veins electrically:

> That's simple enough. It don't require any new instrument. You secure a good circuit connection and you can determine, after a little experience, the extent of the vein with a galvanometer or any other measure of electricity. The bed rock won't conduct electricity for a cent. Even if it's a solid homogeneous mass, which it isn't, it would have very little conductivity, but it's surrounded by a good clay bed, saturated with water and a splendid conductor. The extent of the current would show the extent of the clay bed, and the latter is a sure indication of the extent of the bed rock. It will not require tunnelling or even the expensive uncertainty of the diamond drill to determine where and what the vein is and its direction. Of course, an operator would have to have a little experience, but that he could get after a few observations. ["Edison's Trip and Inventions," *New York Daily Graphic*, 28 Aug. 1878, Cat. 1240, item 858, Batchelor (*TAEM* 94:338)]

Edison also gave reporters his impressions of the mine's interior and discussed a means of cooling the stifling shafts (see Doc. 1475 n. 2).

5. George Ladd was president of the Gold and Stock Telegraph Co. of California, which had been formed in April 1878. He had been involved in the California telegraph industry for many years and had served as assistant superintendent and then secretary and treasurer of the California State Telegraph Co., which Western Union acquired in May 1867. He became assistant superintendent of Western Union's Pacific division in 1871, but resigned two years later when he became president of the Electrical Construction and Maintenance Co., later the California Electrical Works. Reid 1879, 502–3, 506, 595; Ladd's testimony, 3–4, 6, and Paul Seiler's testimony, 19, *Ladd v. Seiler.*

-1394-

From Stockton Griffin

[Menlo Park,] Aug 5, 78

Dear Al

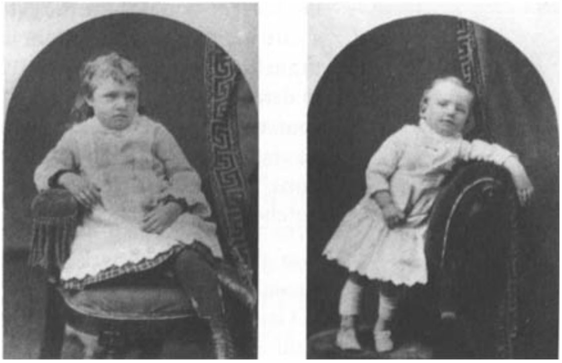
Pope returned from Europe last week—

Mrs. E's health is not of the best— She is extremely nervous and frets a great deal about you, and about everything— I take it to be nervous prostration— She was so frightened yesterday for fear the children would get on the track that she fainted—[1] This morning I telegraphed Dr Ward[2] who came at noon She is better now, but I have advised her to make her proposed trip among her friends at Whitestone L[ong]. I[sland].[3] as soon as possible and she will start Thursday next— She needs a change and right away, as the cars keep her awake at night and this causes her to lose strength— Of course theres nothing serious in this, but I thought it might be of interest[a] to you. If she should grow worse I would Teleg you.

The W.U. will not have your P&C Telephones they prefer Phelps style which he is now getting up arranged so one can write while they receive a message.[4] I delivered 2 to Wexel & De Gress today—[5] Yrs &c

S.L.G.

ALS, NjWOE, DF (*TAEM* 15:1032). [a]Obscured overwritten letters.



Marion and Thomas Edison, Jr., in 1878.

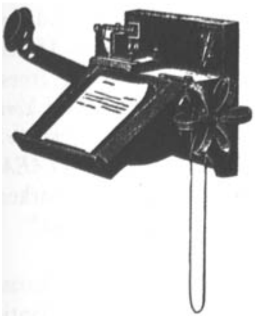
1. The children were Marion Estelle Edison, five and a half, and Thomas A. Edison, Jr., two and a half years old.

2. Newark physician Leslie Ward had probably been the family doctor when the Edisons lived in that city and he continued to treat the family for many years. *Holbrook's Newark City Directory* 1871, 643; *TAEM-G1-2*, s.v. "Ward, Leslie D."

3. Mary had relatives living in Whitestone, which is located in north central Queens County. It was at this time an outlying suburb of New York City and a summer resort. John Hipple, who had married one of Mary's father's stepdaughters from his first marriage, lived there; her

father's other stepdaughter, Sarah Jordan, may have been in Whitestone then as well. TAE to Sarah Jordan, 7 Oct. 1878, and Jordan to TAE, 11 Oct. 1878, both DF (*TAEM* 16:191, 225); Stillwell family genealogy sent by Mrs. J. Ellsworth Doughty, 9 Mar. 1956, EBC.

4. Prescott 1878d (p. 602) described this instrument as "a convenient way of arranging the apparatus for shop, counting-room, and various other purposes. An Edison carbon telephone, jointed to a projecting arm, so as to be capable of movement in different directions to suit the operator, serves as the transmitter, and the Phelps crown instrument as the receiver, the calls being given by an ordinary telegraph-sounder and a key or switch which is provided for interrupting the circuit."



A telephone set combining a small writing desk, an Edison transmitter, and a Phelps receiver.

5. The firm of Wexel & De Gress sold arms and munitions in Mexico, Chile, Peru, and Panama, and had offices in New York City. On 25 July, J. W. Wexel had written to Griffin from New York requesting "one Edison Telephone with two Instruments, one for each end, with Instructions how to apply same to a common telegraph line. Also if we can guarantee its well working for 300 miles." On 29 July, Wexel assured Griffin that the lines to be used "will not cross any river or water of any kind." The telephones were to be delivered by 5 August; the firm paid $70. Wexel & De Gress were also attempting to arrange a phonograph agency for Mexico with Charles Cheever and by October they were exhibiting the phonograph there. They subsequently sought an exclusive agency in Mexico for the phonograph, telephone, and electric pen. On 16 December, Wexel also sent Edison a Smith & Wesson revolver and one hundred cartridges as a gift. Wexel to Griffin, 25 and 29 July, 9 Aug., 26 Oct. 1878, and 9 Nov. 1878; Frederick Beardslee to TAE, 21 Oct. 1878; Wexel to TAE, 21 Oct., 22 Nov., and 16 Dec. 1878; all DF (*TAEM* 19:878–79, 883, 886; 16:319, 417, 300, 470, 521); Cat. 1217:179, Accts. (*TAEM* 22:745).

-1395-

Frank Rae to Stockton Griffin

San Fran Aug 7 1878[a]

S L Griffin

Mr Edison left for Yosemite Third[1] Will reach Rawlins on Twelfth does not return to San Fran Two Letters rec'd & forwarded to Rawlins[2]

Frank B Rae[3]

L (telegram), NjWOE, DF (*TAEM* 15:1039). Written by Stockton Griffin; letterhead of T. A. Edison. [a]"187" preprinted.

1. At the time of Edison's visit the Yosemite Valley was a state park, granted to California by Congress in 1864. Edison arrived in mid-afternoon and, according to newspaper accounts, rode immediately to the top of Glacier Point and descended after dark. The next morning he traveled to Mariposa, southwest of the park. As Edison described it, the trip to Mariposa through the Sierra Nevadas was made by "a mighty jolly party of us—in one of the big six horse stages, and the way we turned the sharp corners on a dead run, and looked down 2,000 feet of rock wall, was exhilarating. Those drivers don't want more than six

inches of road to spare, and I think they'd risk it on half an inch." Edison spent the night of either 6 or 7 August at the Mariposa Big Tree Hotel. He also paid the hotel for passage to the Mariposa Grove of Big Trees, a noted stand of sequoias. "Edison's Trip and Inventions," *New York Daily Graphic*, 28 Aug. 1878, and "Four Hours With Edison," *New York Sun*, 29 Aug. 1878, both Cat. 1240, items 858–59, Batchelor (*TAEM* 94:338–39); Mariposa Big Tree Hotel receipts for Edison and Barker, DF (*TAEM* 17:288); Gudde 1969, s.v. "Yosemite" and "Mariposa."

2. See Doc. 1385 n. 1.

3. Frank Rae was the electrician for Western Union's Pacific Coast division from 1877 to 1881. He had previously managed the Atlantic and Pacific Telegraph Co. office in Syracuse but resigned in 1873 to become chief operator for Western Union in New York, a position he held until 1877. Taltavall 1893, 301–2.

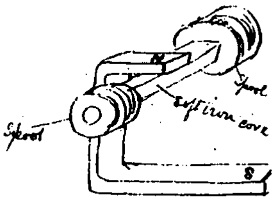
-1396-

Charles Batchelor to James Adams

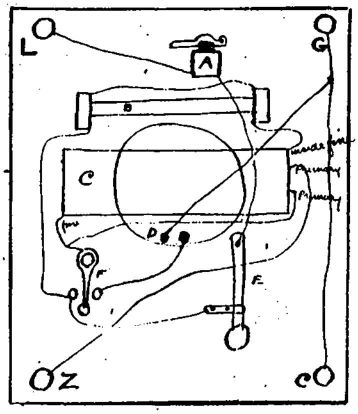
[Menlo Park,] Aug 9th [187]8

Dear Jim,

Yours of July 27th to hand.[1] I sent you yesterday 1[a] one new press and carbon moulds complete with a canister full of lamp black to begin with.[2] this is packed in a box and marked for Puskas care of Gouraud London. I also sent another case containing 4[a] four of our new telephones two for Puskas and ~~2~~two for Gouraud, the transmitters are taken out and soldered up in tin cans. there are also two wrenches for them. You had better go to London to get them as I wrote Gouraud[3] that ~~no doubt you would have to unpack or perhaps~~ I anticipated you would unpack them therefore I gave him no instructions. Of course you need not go if you can get the boxes shipped to you and then afterwards take Gourauds telephones to him. And now Jim the reason why I did not send more of them is this. When I designed it, Edison would have large diaphragms in the receivers and they are very loud on ordinary wires, and excellent between here and Philadelphia on two cells of Callaud; but whilst Edison is away I have tried them on Short cables and wires running 70 on the pole; now I must confess although it worked well I would prefer two of our little receivers and therefore I think you know what will suit their wires best, of course I know when Edison hears this new one, he will be delighted because you know it is difficult for him to get anything on a small diaphragm, but for us who have good ears we prefer to have less noise and clear talking[4] Therefore as I do not think they will be exactly what you want I only sent one for P. and one for G. I shall send you a Phonograph (not a clockwork) on 15th of this month. We have not the Johnson instrument[5] here but I will try and put something together and send at same time as the phonograph comes. You will find the transmitters I have sent have a silk disc on top of the carbon button. These carbons are very delicate being pressed and sifted a number of times they are very loud and if they dont have the silk on top there gets a rattle (slight) in it with such a thick plate. You will see Jim that the shape of the receiver is altered in this, and we[b] have got the best form of magneto as it is a stroke of lightning cannot affect it; it is just as free from it as a Sieman's armature.[6]



Here is a rough diagram of the connections for it.



A is sounder B iron core on magnet with spool on each end. C coil;[7b] D transmitter; E Key,[8] F is switch[9] to the right for telephone to the left for call. The two top bindposts are Line and ground and the bottom are battery and you will find them in pairs as far as the Z[inc] & C[arbon] marks are concerned as you know they must be reversed at each end. There is a wire sticking out of transmitter that is connected to the loose wire in telephone box and the three screws that fasten it make the other connection.

I have never used more battery than two cells callaud on them but you suit yourself. Whoever you learn to use the press impress upon their minds to be careful as the dies are easily spoiled. Also be careful in unpacking same and Jim dont let anyone press anything else in it as I nearly spoiled mine by adding sulphur and pressing it. I think Bliss will write you on Beetle matter. Mac thinks Beetle is an old woman and dont know how to run the business   Yours as ever

Chas Batchelor

ALS (letterpress copy), NjWOE, Batchelor, Cat. 1330:18 (*TAEM* 93:233). [a]Circled. [b]Obscured overwritten letters.

1. Not found.

2. What may be a copy of Batchelor's instructions for the carbon mold is found in NS-Undated-006, Lab. (*TAEM* 8:506; see also 8:508).

3. TAE to Gouraud, 8 Aug. 1878, Lbk. 3:334 (*TAEM* 28:775).

4. Two weeks later Batchelor wrote Adams, "In working one of the lines to Brooklyn . . . I found that the big diaphragms in the receivers I sent you were not so good as our little receivers; of course we knew this beforehand but Edison I suppose thought he could take it up by thick large diaphragms." He then described "what I have done with a pair of them for the Brooklyn wires, so that you can get them altered to suit your wires." Batchelor to Adams, 23 Aug. 1878, Cat. 1330:31 (*TAEM* 93:246).

5. Unidentified. However, it is possible that Batchelor is referring to a device that Johnson developed in June, which James Redpath described as "a first rate apparatus as a transmitter for sending songs by telegraph from a distance." Redpath to Gardiner Hubbard, 10 June 1878, ESP Lbk. 1:395.

6. That is, like the armature of the Siemens polarized relay (see *TAEB* 1:38 n. 1). Text is "Spool," "soft iron core," and "Spool."

7. Text for the induction coil connections is, clockwise from upper right, "inside fine," "primary," "primary," and "fine."

8. The key E is at right below the induction coil C.

9. The switch F is at left below the induction coil C.

-1397-

Edward Johnson to Uriah Painter

New York, Aug 9th 1878[a]

My Dr U.H.

We shipped yesterday ~~2 Larg~~

2 No 3's @ $250. Each—Missouri & Louisiana

2 No 2's @ 150.[1]   "   Arkansas & Iowa

We ship today one "3"—@ $250. to Alabama— A good portion of the money has been paid in hence the Treasury is "Solid"   You must change your tactics   You cannot Bankrupt the Treasury of this concern by prompt payment of its liabilities.

Bailey[2] and I had a tilt yesterday— I was at Bergmans working like the Devil up to one oclock—had ½ Dozen customers to witness operation of Phonos, & was very busy helping Bergman get the No 1's out of their boxes and on the bench for remodeling—[3] When I came down here Bailey made a raid on me for not coming earlier in the day— He had 3 orders & had been holding them all day. I asked him why he did so— Said he had no boy &c &c— I gave him to understand in language Emphatic that it was as competent for him to bring it to me as for me to come for it. He cooled off soon at that and took it out in Cockish Airs about paying bills on your unsupported approval— I tendered the Rubber stamp bill $6.75— to which he remarked—"I wont pay bills on that mans approval alone" I said I dont expect you to but I do expect you to get an additional signature upon my certificate and the approval thereof by one member of the Ex. Com. He said it was not his business to do anything as Treasurer but Pay— when properly approved.

I've not got the Telephone in yet I inquired of the Lineman as to which wire it was, & upon his suggesting that he had better do the work, I assented & made an engagement to meet him there at 10 AM the next morning. Meantime he informed Cheever—who p~~ree~~remptoraly ordered him not to put it in— I had some trouble in finding my Telephones but finally found them today—so shall put the wire in myself this afternoon.

I had two parties at my Laboratory today to see machines at work— One Columbia S.A. party and one U.S. roving party—both came to buy No 2's and both went away to consider the payment of an additional $100 for the No 3. I've got a new kink on the adjustment of the needle—and can now get the maximum loudness of Tone at once heretofore it was a matter—as Edison termed it—of "fooling till you get it"— In short I am rapidly ~~obtaining~~ ascertaining[c] the conditions which yield the maximum of tone & articulation— A few more steps and the boundary of the Scientific Toy—will be passed and the realm of the Practical will be entered— I am so confident of this that I am anxious to know wherein I am to be benefitted I do not think $150. per month is sufficient pay for what I am doing— I fully believe that if the company were to appropriate[b] $500 for my use to enable me to experiment for the production of a Standard Instrument I could do it within 90 Days. But it would inevitably result in its production even if I did not as Edison would never allow me to pass him if he had to put every man in his employ on the Phonograph. I have seen him pushed to the wall in this way and with always one result—viz—his winning the race

I have tried the Diamond point and while I get good talking from it I still get the scraping my mind is made up on this point & is[d] to the effect that the scraping is due—after a certain degree of smoothness has been obtained in the needle—solely to the surface of the foil— I shall now experiment for the production of a cheap silver compound and drop the Diamond point experiment We Know what silver will do—it only remains to cheapen it.[4] What is this worth to the Co? In my judgment more than anything Edison has done since you made the contract, remembering that the majority of the details of the improved machines have been my work— If you can have me installed as chief mogul I will go on in the good work, if not I shall be tempted in common justice to myself and mine—to confine the results of my experimenting to my individual[b] machine & to the privacy of my Laboratory until a more auspicious time.

The Scientific American of this week is out with an ad. of their supplement containing full drawings of the Phonograph and advising anyone who wants a Phono to invest[b] 10¢ in the supplement—and make their own— I am going to show them up to Croffut of the Graphic and if he will publish a letter from me in connection with the report he is going to make of our[b] "Development of the Phono" I'll write such an one as will place Mr[b] Beach[5] under the charge of Blackmailing us for advertizing patronage

Doubtless you will leave the Hill in time to miss this Letter Yours Truly

E. H. Johnson

ALS, PHi, UHP. Letterhead of Edison Speaking Phonograph Company. [a]"New York," and "18" preprinted. [b]Obscured overwritten letter. [c]Interlined above. [d]"& is" interlined above.

1. The sale prices of these phonographs were $200 and $100 respectively, including supplies; another $50 was added for James Redpath's exhibition commission. Edison received twenty percent from Redpath's commission dollars as part of his own exhibition royalty as well as royalties on the $185 and $95.50 price of the machines, excluding supplies. The $100 phonographs were modified iron cylinder machines that had been used by exhibitors (see Docs. 1276 n. 1 and 1334 n. 2). Beginning in June flywheels were added to these machines and additional design changes were apparently made during July. S. Bergmann & Co. remodeled the old exhibition phonographs by "putting on fly wheel cutting slot in Cylinder [putting] in new mouth pieces [and a] mica Diaphragm;" they also began to manufacture new iron cylinder

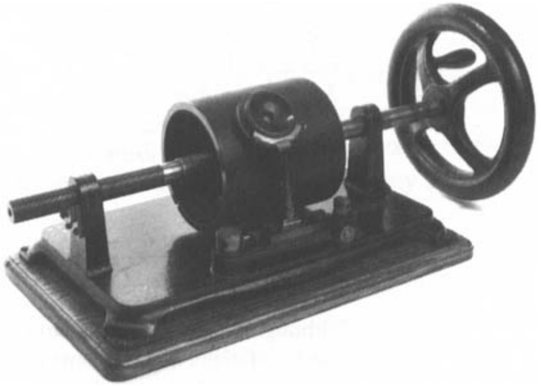
phonographs by the end of August. According to James Redpath, the "difference between the $100 and $200 machines is that the former are not so perfect in their workmanship, the cylinders are made of iron instead of brass, and in the latter there are contrivances by which they are more easily worked. For example, instead of turning slowly a crank to reverse the cylinder as in the smaller machines, the $200 instruments have an arrangement by which they can be thrown back in one motion" (see Docs. 1369 and 1416). The $200 machine was "much more easily managed [and] less liable to get out of adjustment," as well as being "much better made," and also had "a more natural tone and articulates more perfectly than the $100, and it is better for reproducing musical sounds." Furthermore, while the $100 phonograph "can be heard clearly in any ordinary hall . . . [t]he other can be heard throughout any hall in the U.S." Johnson to Painter, 17 Aug. 1878 and Bergmann & Co. bills to Edison Speaking Phonograph Co., 10, 24, and 31 Aug. 1878, all Box 4, UHP; Redpath to T. Addison, 17 Aug. 1878; Redpath to Edd. Annable, 17 Aug. 1878; and Redpath to W. W. Wright, 5 Aug. 1878; all ESP Lbk. 4:483–84, 478–79, 331–32, UHP.

Both machines came with instructions, written by Edward Johnson, "which enable anyone of average capacity to master all details connected with the practical operation in a short time—a day or two at most." The ease of use of these new models marked a significant improvement over the original exhibition machines, about which Redpath told one correspondent, "Written instructions wont help you, because although you might be able to run it imperfectly, you could not obtain the best results without some personal instruction. If the needle got out of adjustment, you would be quite helpless. We have nobody who can teach you nearer than Washington or Cincinnati. We do not want to take your money and place you in a position where you will not only have no returns, but find yourself with a sort of white elephant on your hands." "Edison's Speaking Phonograph. Instructions for Operating," Box 4; Redpath to J. W. Dewey, 29 July 1878, ESP Lbk. 4:206–7; Redpath to C. Barnes, 3 June 1878, ESP Lbk. 2:164; all UHP.

Redpath's exhibition royalty proved a sore point with Johnson, who reminded Painter in a letter of 16 August, "I told you that I thought the plan of allowing Redpath to sell machines with Royalty, would result in his forcing down the price of the machine for the sake of the royalty." He went on to complain that a customer who wanted one of the big phonographs was unwilling to pay $250 but, because Redpath was unwilling to reduce his commission and sell it for $225, settled for an old exhibition machine instead.

> The result of all this [is] that our expensive machines remain on our hands—& our poorest hand is shown to the Public. I do not like the prospect. I want the Big machines to go. You must put an embargo on this traffic in 2nd hand machines at once— My 25 new ones are fairly under way. 12 of them are to be finished up at once the remaining 13. will be at my command— If I bring my two styles Nos 2. & 4. to the notice of a purchaser on even terms in all except the simple price of the machines 100 & 200 I'll sell him the 200 everytime and its a good deal more money in our pockets. [UHP]

It is unclear what the difference was between a No. 4 and a No. 3 phonograph (but see Johnson to Painter, 6 Aug. 1878, UHP, and Doc. 1419 n. 4). Two of the $200 machines had been sold in July and royalty reports indicate that nine of fifteen phonographs sold in August and all thirteen sold in September were $200 machines. Somewhat ironically, sixteen $100 but only seven $200 phonographs were sold in October when the exclusive exhibition contracts ended and Redpath was no longer connected with the company. Johnson to Painter, 29 July and 16 and 17 Aug. 1878; and Bergmann & Co. bills to Edison Speaking Phonograph Co., 23 July, 3 and 10 Aug., 9, 14, and 28 Sept., and 15 Oct. 1878; all Box 4, UHP; Edison Speaking Phonograph Co. royalty statements for July–December 1878, DF (*TAEM* 19:187–204); see also headnote p. 449.



An early exhibition phonograph with an added flywheel.

2. Charles Bailey was treasurer of the Edison Speaking Phonograph Co. *TAEM-G1*, s.v. "Bailey, Charles E."

3. These were apparently the small phonographs (Doc. 1195). S. Bergmann & Co. altered eight of them in August (presumably to add some of the features adopted for the large phonographs; see note 1 and headnote p. 371, n. 10). The company offered them as "a Small iron machine, suitable for experimental purposes to show the principle of the invention price $50." The price increase was apparently due to the six dollar cost of alteration. Charles Bailey to Henry Dennison, 26 Aug. 1878, and Bailey to Prof. W. L. Seymour, 31 Aug. 1878, both ESP Lbk. 3:66, 83, UHP.

4. On 6 August, Johnson had written Painter that

> Bergmans discovery is equally Important. He finds that pure Silver foil—very thin—costing less than 2 cents a sheet—is as readily indented as tin foil—while being much harder—and very strange to say—although a hard surface—the needle passes over it absolutely quiet—thus permitting all the finer articulations to be distinctly recognized— At the same time the greater rigidity of the Indentations cause a more decided vibration of the plate and a consequent louder tone. [UHP]

They apparently succeeded in developing it by late September, when James Redpath noted an improved tinfoil (Redpath to J. W. Rich, 23 Sept. 1878, ESP Lbk. 5:229–30, UHP). The new foil was offered in S. Bergmann & Co.'s circular of 22 October:

After continued and expensive experiments to find some way of getting rid of the unpleasant "scratching" of the needle in the Phonograph, we have succeeded in producing a superior quality of foil, which almost entirely obviates that trouble.

This foil we are now prepared to furnish in boxes containing 300 and 600 sheets, each @ one and five=eighths cents per sheet. Being of a different composition from that heretofore used, it can be used to advantage only on machines provided with the wedge fastening.

Shellac, or other gums not readily adhering to it, it cannot be used on machines having that method of fastening. For these machines we will furnish the old style of foil at one and one=eighths cents per sheet, in packages of 170 and 420 sheets each. [UHP]

5. Alfred Beach was an Editor and part owner of *Scientific American. DAB,* s.v. "Beach, Alfred Ely."

-1398-

From Stockton Griffin

Menlo Park Saturday Aug 10. 1878

Friend Al

Mrs E went to Whitestone L. I. Thursday to be absent a week or ten days. Batch and the rest are just starting for Woodbridge to take the Schooner for a sail. They only chartered it for one day.[1] I recd your Telegram about Scientific Amns (July 10th)[2] and had George get 100 today[3a]— I would have had 200 mailed when they first appeared[b] had not Batch thought we could'nt afford to buy them. I write now to send a copy of a letter from Sir Wm Thomson which explains itself. Evidently Preece has brought no little pressure to bear on Sir Wm T in order to induce him to write as he does— Its "bad medicine" I think but I guess you will survive it. The Clockwork Phono with new Gov was started today & gives much better results than previous experiments but yet it is not quite perfection. Everything quiet except that Exstrom was discharged day before yesty by Kruesi— Dont know what for.

N. L. Narso the Turk (Armenian) wants 2 telephones for Turkey. I telegphd you today but have recd no ans as yet.[4] Got the first phono from Pool yest'y.[5] Haven't tried it yet. Batch is making new mouthpiece for an Experiment He was at Pools all day yesty says they are all right Yrs &c

Griff

ENCLOSURE[c]

Cowes July 30. 78[6]

Dear Sir

I enclose a copy of a letter I am sending to "Nature" and to the NY Herald and the NY Tribune.[7] I am sending copies of it also to Mr Preece and Mr Hughes

Believe me Yours Truly

William Thomson

ENCLOSURE[c]

Cowes July 30. 78

Sir.

The pleasure with which those beautiful discoveries and inventions, The Telephone, The Phonograph and the Microphone have been appreciated by the world has been unhappily, and I must say, I think unnecessarily—marred by one of the most disagreeable things that can be thrust on the public—a personal claim of priority accompanied by accusations of bad faith, especially when made against anyone of whose name and fame the public has come to feel concerned.

Before troubling the public at all with such a matter Mr Edison might surely have reasoned out his claim[d] with Mr Preece with whom he had been[a] from the beginning in correspondence; or he might have written immediately to the public journals calmly pointing out the close relation between[a] his own "Carbon Telephone" and Mr Hughes subsequent "Microphone." The scientific public could then have calmly judged and would have felt much interest in judging how much in common or how much not in common there may be in the physical principles concerned in the two instruments. But by his violent attack in the public Journals on Mr Preece and Mr Hughes charging them with "piracy" and "Plagiarism" and abuse of confidence he has rendered it for the time impossible for either them or others to give any consideration whatever to his claims. Nothing can be more unfounded than the accusations! Mr Preece himself gave at the Plymouth meeting of the British Association last August a clear and thoroughly appreciative description of Edisons Carbon Telephone and published it in the printed reports of his lecture which appeared in the public journals! The beautiful results thereon since the beginning of the present year by Mr Hughes with his microphone were described by himself in such a manner as to leave no doubt but that he had worked them out quite independently and that he had not the slightest intention of appropriating any credit due to Mr Edison. It does seem to me that the Physical principle used by Edison in his Carbon Telephone and by Hughes in the Microphone is one and the same ~~thing~~ And that it is the same as that used by M Clérac[8] of the French "Administration des lignes telegraphiques" in the variable resistance carbon tubes which he had given to Mr Hughes and others for important practical applications as early as 1866 And that it depends entirely on the fact long ago pointed out by Du Moncel that increase of pressure between two conductors in contact produces diminution of electric~~al~~ resistance between them.[9]

I cannot but think that Mr Edison will see that he has let himself be hurried into an injustice and that he will therefore not rest until he retracts his accusations of bad faith publicly and amply as he made them

I am your obedient servant

(Signed) William Thomson

ALS, NjWOE, DF (*TAEM* 15:1048). [a]Interlined above. [b]"when . . . appeared" interlined above. [c]Enclosure is an L (transcript) written by Griffin. [d]"his claim" repeated, probably as page turn in original.

1. The time sheet of laboratory assistant George Carman for 11 August reads "fishing." Extant time sheets for all but two other laboratory workers are blank for that date. DF (*TAEM* 17:670–76).

2. Edison's telegram has not been found. Griffin meant the 10 August issue of *Scientific American,* which contained a letter from David Hughes on the microphone, a critical editorial response, and an article entitled "Crooked Journalism" on *Engineering's* contribution to the controversy. Sci. Am. (39:80, 84, 88), Cat. 1032:3–4, Scraps. (*TAEM* 27:804–5).

3. George Carman was sometimes assigned to purchase extra copies of newspapers and magazines during the spring and summer; his time sheet indicates that he spent 10 August in New York. The *Scientific American* copies were probably intended for the foreign individuals and publications to whom Edison and Batchelor had sent the journal's 8 and 22 June issues concerning the microphone. Carman's time sheet, DF (*TAEM* 17:671); Batchelor 1308:66–74, 274–75, 282, 287 (*TAEM* 90:700–4, 783, 786).

4. Nothing is known of Narso. On 10 August, Griffin wired to Rawlins for Edison: "Has Puskas got Turkey for Carbon Telephone Can I sell two to go there." Edison replied on 12 August from Ogden, Utah: "You can sell in Turkey." DF (*TAEM* 19:888, 893).

5. See headnote, p. ###.

6. Thomson wrote this letter and the one following aboard the yacht *Lalla Rookh* at Cowes, on the Isle of Wight.

7. The *New York Tribune* printed Thomson's letter on 12 August. In its accompanying editorial, the paper claimed that Edison's earlier appeal to Thomson's impartiality now obliged him either to rebut the letter or apologize to Preece (Cat. 1240, items 820–21, Batchelor [*TAEM* 94:318]). It was published in the 1 August issue of *Nature* (18:355) and the 11 August *New York Herald* (p. 7).

8. Hughes himself had pointed this out in a letter to *Engineering* and other publications ("The Hughes Microphone," *Engineering,* Cat. 1240,

item 790, Batchelor [*TAEM* 94:297]). In his discussion of the history of the microphone, Du Moncel (1974, 144) noted that as early as 1865 Clérac had "employed a tube made of plumbago, and provided with a movable electrode, to produce variable resistances in a telegraphic circuit." Hippolyte Clerac was Inspecteur Ingénieur des Télégraphes, Paris. Clerac to the Editor, Teleg. J. and Elec. Rev. 7 (1879): 65.

9. Between 1856 and 1875, Du Moncel had conducted several experiments on the changing resistance of substances under pressure. He published his results in the second edition of his *Exposé des Applications de l'Electricité* and "in several papers presented to the Académie des Sciences, and inserted in their *comptes rendus*." Du Moncel 1974, 144.

-1399-

James Adams to Charles Batchelor

Paris, le Aug 11th 1878[a]

Dear Sir

I wrote you a few lines the other day, but give you very little news.[1] I shall give you all I know now gave an exhibition of telephone on Thursday to financial men, and Friday for for the press. experiments was most succes~~s~~ful, and I think that Telephones in a financial point of view is O. K. Baily is pushing Puskas hard to—accept 50,000 franks[2] cash and so much stock of the company, he is afraid that Puskas will back out Puskas also has an offer of 100,000 fr. for France and Russia, but I think that he will do better than either. as Baily cant do anything with either Phelps or Gray, the Edison was the only one exhibited as it was useless to try to show any magneto telephone—where there was 50 or 60 Frenchman and everyone talking at once Some of the newspapers says that the Gray telephone ~~ar~~ was shown but it was not so papers that said so was well paid for it by Baily if it was not that they are working together I should have contradicted it. to show you what kind of a fellow Baily is, he came to me in the hall and says its no use to try to show off either the Phelps or Gray, so you just show your telephone and I will say that it is a combination of all three, for if we try to show the magneto it will be a failure and give those men that has come here with the intention of putting money in it a bad impression. I says do what you like but if anyone asks me I must tell the truth so enters Dr Hertz, with six of the richest men in europe the Hall was crowded. he stands on one side and asked for silence everyone got quite and then he introduced me and Puskas & Baily to the gentlemen present, and said gentlemen it is no use wasting your time trying either the Phelps or Gray telephones. the Edison telephone is what you want to listen to and the only telephone that is worth a dam. Baily felt fearful bad over it, and Hertz is a sorry man to day that he let the Edison telephone slip through his hands. he says he was a damed fool, and it was that son of a Bitch Preeces fault for he advised him ~~h~~ to have nothing to do with it. I used 12 receivers in circuit, and could have put in as many more if I had them. I ~~pl~~ showed that I could talk 10 feet away from transmitter in a very low tone and get it red hot at other end. on short line you can talk 50 ft away from transmitter and get it splendid I have got bang up receivers I hope you will send me some as good. I have been asked by some of the men that is going to buy telephone if I should stay in Paris and get everything in running order for them, and that they would pay me well for it, and I said I should providing Edison would give his consent. write you in a few days and give you drawings and all about how the Phonograph received from Telephone[3]

I will be at Dover next week[4] and will take a run up to London for a day as I want to get my galvanometer and other things

AL, NjWOE, DF (*TAEM* 19:891). Letterhead of Theodore Puskas. [a]"Paris, le" and "18" preprinted.

1. Adams had written to Batchelor the day before: "Telephone better than I ever expected to get them everything favorable I think you may expect to get money from telephones in about 3 weeks. I think in about that time everything will be fixed." DF (*TAEM* 19:889).

2. At this time the monetary exchange rate was roughly five French francs for one U.S. dollar, twenty-five per British pound. *Ency. Brit.*, s.v. "Money."

3. Not found.

4. In his letter of the previous day, Adams had indicated that he would "experiment on Dover cable tomorrow week," meaning Sunday, 18 August. Adams to Batchelor, 10 Aug. 1878, DF (*TAEM* 19:889).

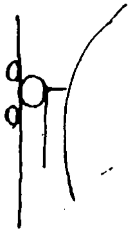
-1400-

Technical Note: Phonograph

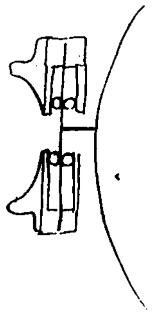
[Menlo Park,] Aug 13th 1878

Speaking Phonograph.[a]

I find that the hissing consonants are by no means perfect on the phonograph that they are ~~worst when no damp~~ improved when a piece of match is put in the rubber, this we all well knew, but it led me to enquire why it was so and I find that the putting in of a match only stiffens and makes more solid the spring to diaphragm.



that in our ordinary dampened diaph. when the hissing consonants are given the diaph works between the dampeners and the spring rubber, and the point lies dormant against the tinfoil. The remedy I propose is to make point solid on diaph and dampen both sides thus:—[1]



so that the slightest hiss will come on the tinfoil

T A Edison[2] Chas Batchelor

J Kruesi M. N. Force

X, NjWOE, Lab., Vol. 17:133 (*TAEM* 4:997). Written by Batchelor. [a]Followed by short horizontal line.

1. Two days later, Batchelor wrote of this design that it "gives equally good talking without the spring . . . the articulation on this is slightly improved but it has more harmonical sounds owing to the point being direct on the diaphragm." Cat. 1317:63–65, Batchelor (*TAEM* 90:688–89).

2. Edison witnessed this note after his return from his western trip.

-1401-

Paper for the American Association for the Advancement of Science

August 15, 1878[1a]

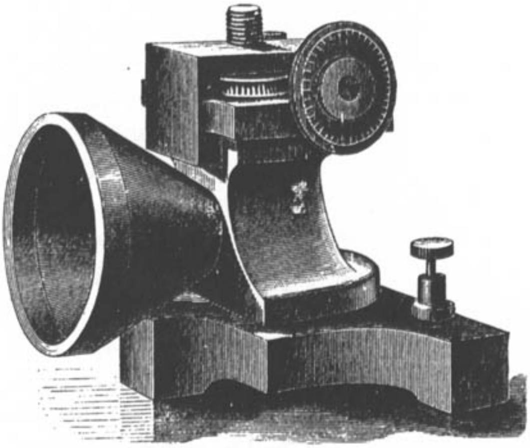
On the use of the Tasimeter for Measuring the Heat of the Stars and of the Sun's Corona;* by THOMAS A. EDISON, Ph.D.

To Prof. Henry Draper, M.D., Director of the Draper Eclipse Expedition:

Dear Sir: The instrument which I used at Rawlins, Wyoming, during the solar eclipse of July 29, 1878, for the purpose of measuring the heat of the sun's corona, was devised by me a short time only before that event, and the time was insufficient to give it as thorough a test as was desirable to ascertain its full capabilities and characteristics.

This instrument I have named the tasimeter, from the Greek words ταριϭ, extension and μετρον, measure, because primarily the effect is to measure extension of any kind. The form of instrument which I used is shown in the annexed wood cut (Fig. 1.)

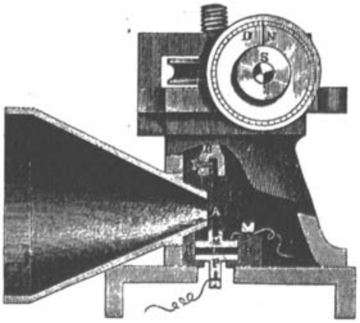
Fig. 1.



With this instrument was used a Thomson's reflecting galvanometer[2] on a tripod having a resistance of three-fourths of an ohm. The galvanometer was placed in the bridge wire of a Wheatstone balance, two of the branches of which had constant resistances of ten ohms each, while of the other two one had a constant of three ohms, and the other contained the tasimeter which was adjusted by means of the screw to three ohms.[3] When thus balanced, if the strip of vulcanized rubber placed between the fixed point and the carbon button (seen in Fig. 2), was exposed to heat from any source, it expanded, placing pressure upon the carbon button thus decreasing its resistance and destroying the balance; thus allowing a current to pass through the bridge wire containing the galvanometer, the amount of this current of course being proportional to the expansion of the rubber and to the strength of the battery.

The form of instrument here described was only finished two days before leaving for the west; hence, I was unable to test it.[4]

Fig. 2.



However, I set it up upon my arrival at Rawlins, but found that it was a very difficult matter to balance so delicate an instrument as a reflecting galvanometer with one cell of battery, through such small resistances. In fact, I did not succeed in balancing it at all in the usual way. Nor could it be balanced in any way until I devised a method which I may designate "fractional balancing," when it became very easy to accomplish the result and also to increase the effect by using two cells in place of a single one. This device consisted of a rheostat formed of two rows of pins. The rows were about one-half an inch apart. A wire was connected from a pin on one row to a pin on the other row and so on, so that the current had to pass through the whole length of the wire, which was No. 24 gauge and four feet long.[5] This was used as a shunt around the galvanometer. A copper wire connecting all the pins of one row served to reduce the resistance to zero. When the galvanometer was thus shunted, a very feeble current passed through it. If the spot of light was not at zero it was brought there by either increasing or decreasing the pressure upon the vulcanite of the tasimeter by the adjusting nut. When thus brought to zero the copper wire of the shunt rheostat was taken off of one pin, thus increasing the resistance of the shunt perhaps to one-fiftieth of an ohm. The spot of light was generally deflected nearly off of the scale. The light was again brought to zero by varying the resistance of the tasimeter, and another one-half inch of wire included in the shunt, another deflection and another balance was obtained by the tasimeter. Thus by gradually increasing the delicacy of the galvanometer by increasing the resistance of the shunt and balancing at every increase, the whole of the current was allowed to pass through the galvanometer and the shunt taken off. When this point was reached the damping magnet or director was in close proximity to the case of the galvanometer. To increase its delicacy to the fullest extent it became necessary to raise the director to the top of the rod. This was done by raising it cautiously a quarter of an inch at a time, bringing the spot of light to zero each time by the tasimeter.

In order to form some idea of the delicacy of the apparatus when thus adjusted, a preliminary experiment was made on the evening of the 27th, with the star Arcturus. The tasimeter being attached to the telescope, the image of the star was brought on the vulcanized rubber. The spot of light from the galvanometer moved to the side of heat. After some minor adjustments, five uniform and successive deflections were obtained with the instrument, as the light of the star was allowed to fall on the vulcanite to produce the deflection, or was screened off to allow of a return to zero.[6]

It was in this condition when the eclipse occurred. The tasimeter was placed in a double tin case, with water at the temperature of the air between each case. This case was secured to a Dollond telescope[7] of four inches aperture. No eye-piece was used. At the moment of totality the spot of light was slowly passing towards cold. When I withdrew a tin screen and allowed the edge of the luminous corona to fall upon the rubber, the spot of light stopped, went gradually off of the scale towards heat, its velocity accelerating as it approached the end.

The time required for the light to leave the scale was from four to five seconds.

I interposed the screen and endeavored to bring the light back to zero, but I was unsuccessful. Had I known that the heat was so great I should have used a platinum strip in place of the vulcanite, and decreased the delicacy of the galvanometer by the approach of the damping magnet. I then would doubtless have succeeded in getting two or more readings, and afterwards by comparison with bodies of known temperature would have obtained a near approach to the temperature of the sun's corona.[8] Respectfully yours,

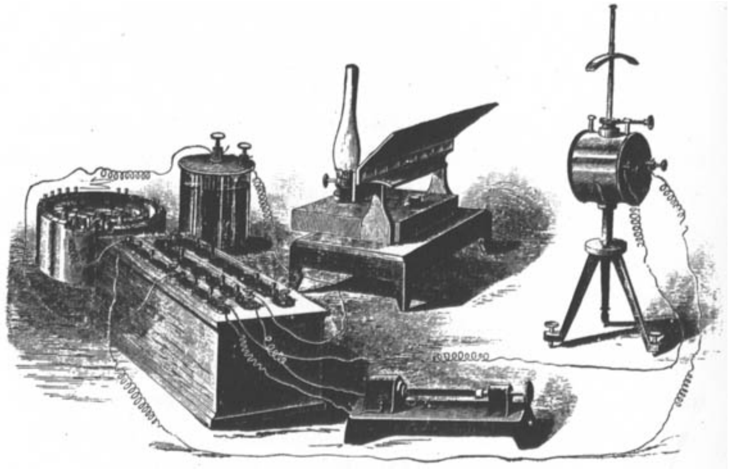
Thomas A. Edison.

*Read, by permission of Dr. Draper, at the St. Louis meeting of the American Association.

PD, *Am. J. Sci.* 3rd ser. 17 (1879): 52–54. Preceded by "Art. V." [a]Date not that of publication.

1. This report is apparently the only one Edison himself read of the four reports that he presented on 23 August in Section A of the American Association for the Advancement of Science meeting in St. Louis; George Barker read the others. See "The Scientists," *The Chicago Tribune,* 24 Aug. 1878, 3; and Doc. 1406 n. 6. It was also published in the Association's *Proceedings* (27:109–12).

2. William Thomson developed this type of galvanometer for submarine telegraphy. It consisted of a small mirror, with a magnetized needle on its back, suspended vertically in a thin circular coil of insulated wires. Passage of a current through the wires deflected the needle, causing a beam of light reflected by the mirror to move along a horizontal graduated scale. *DSB,* s.v. "Thomson, William;" Knight 1877, s.v. "Galvanometer."



An earlier form of tasimeter (lower center) and apparatus with which to use it, including resistance boxes (left), mirror galvanometer (right), and the galvanometer's lamp and screen with scale (center).

3. The apparatus was shown, with an earlier form of the tasimeter, in a 22 June 1878 *Scientific American* article that was widely reprinted. *Sci. Am.* (38:385); Cat. 1240, item 681, Batchelor (*TAEM* 94:233).

4. See Doc. 1364 n. 1.

5. Following his return from the west Edison made drawings of this "fractional rheostat." NS-78-003, Lab. (7:783–84).

6. John A. Eddy of the National Center for Atmospheric Research analyzed Edison's measurement of Arcturus. Based on contemporary newspaper reports, Eddy noted that Edison claimed the tasimeter could detect a temperature difference as small as 10^{-6}F. Eddy's own analysis showed that this was a reasonable claim; however, he also determined that Edison's detection of heat in the light from Arcturus "indicates a Noise Equivalent Power for the tasimeter of 10^{-8} watts or better, in the detector terminology of today. . . . This conservative estimate ranks the tasimeter far below modern, room-temperature infra-red detectors; as compared to the best cooled detectors of today the tasimeter was four or five orders of magnitude less sensitive." Eddy 1972, 171, 176.

7. George Barker had brought for Edison's use a Dolland achromatic refractor. Barker 1879, 121.

8. Eddy also attempted to reconstruct and analyze Edison's measurement of coronal radiance and confirmed the figure given in Edwin Fox's *New York Herald* account that Edison "had shown the existence of about 15 times more heat in the corona than that obtained from the star Arcturus the previous night." Eddy 1972, 178–80; "The Eclipse," Cat. 1240, item 801, Batchelor (*TAEM* 94:305).

-1402-

From Stockton Griffin

Menlo Park, N.J., Aug 16 1878[a]

T. A. Edison

Adams cables again "Humbugged by Herz and Beetle yesterdays cable no weight—"[1]— Puskas cables "Prospect for disposing french telephone patent extremely good though Herz and Beetle trying hard to spoil it— Beetle secured pen for Herz great pity—"[2]

I advise your coming home at once on account of Mrs Edisons health—

Griffin

ALS (telegram), NjWOE, DF (*TAEM* 15:1057). Letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted.

1. The day before, Adams had cabled Edison: "Can you sell Telephone patents independent of Puskus am offered twenty five thousand dollars for France & Russia or fifty thousand Cash for Europe except England have you received any money from Exhibitions & sales of Phonograph in France Answer me only Post office American Section Exposition." DF (*TAEM* 19:895).

2. Puskas's telegram to Edison on this date is in DF (*TAEM* 19:897).

-1403-

James Adams to Charles Batchelor

Paris, le Aug 18th 1878[a]

Dear Batch,

Telephones making quite a fuss there is three different partys after it. The only thing that I am glad of is that the telephones is worth fighting for and, another good thing the price is away up, and I am very sorry that Edison undervalued the Telephones for European countrys. but if Puskas will do what he told me he would towards Edison, it will be all right anyhow. Puskas told me that, all that he could get for it was 50,000 francs cash and rest in stock. now Herz made an offer to Puskas of 100,000. francs cash for France & Russia and afterwards ~~100~~ 125 000 francs. it is true that Herz is not much of a man but he has got good men behind him. Herz only wanted to buy it for them and not for himself. that was what made Puskas mad at him because he thought Herz would make to much money out of it. he told me that if he let Herz have it for that money, he would sell it for not less than 250,000 francs. I told him I would not care. I would sell the Patents to whoever would give the most for it. so he said that is just what he was going to do and that he could get 150,000 francs for France alone, and that he was not going to confine Edison to the amount agreed upon in contract but give him double what he expects, if he can comand to a big enough price for it. Herz said if he did not get the telephones from Puskas, he would try what he could do with Edison and if he could not get it from him at the same figures that he offered Puskas, he would law for it as he thought he had a right to it yet. but that is all humbug. he knows well that he cant do anything by law. had there not been so many after ~~h~~ it it is my Honest ~~oppinion~~ opinion[b] that 500 000 francs would been all that we would ever heard of no matter what he got for it. but I know although Puskas did not tell me, that 300,000 Francs, is[b] his Price for France and I dont doubt but he will get it. he told me that if Herz tried to cut him out with Edison he would plank down the 40,000 francs agreed in contract, immediately[b] and that would fix all disputes and then he could take his time to carry out his negotitions Telephones is so much better than any magneto telephone, that it impresses everyone favorably the minute they hear it. I am having some experimental receivers made just now as I want to get as small a one as possible, and do the same work. I think I can make one smaller than the Philp,[1] and a magnet 3 times as strong as his. have you been able to kill the induction yet otherwise than by putting thick diaphragm in receiver. I have struck something funny in that line, but I may be mistaken but wont say anything about it till I try further experiment, or you might laugh at a fellow. Puskas wants me to go to Italy[c] as soon as the telephones is of his hands here. once sold here there will be no trouble to go right through all the European countrys there has been some Italians here that has seen it, and [——][d] wants Puskas to come to with it as soon as possible. I will finish this letter ~~as soon~~ in a day or two. as I must keep you posted about everything that I hear and know I have got enough to tell you to fill a newspaper.

Jim

Recd a letter from you to day of shipment of telephones[2] and one from Ellen tell her I am O.K.

ALS, NjWOE, Batchelor, Unbound Documents 1878 (*TAEM* 92:291). Letterhead of Theodore Puskas. [a]"Paris, le" and "18" preprinted. [b]Interlined above. [c]Obscured overwritten letters. [d]Canceled.

1. Phelps.

2. On 5 August, Batchelor had informed Adams that he would send four telephone stations for Puskas and four for Gouraud on the 10th. He also indicated that he was sending to Adams a press and dies for making lamblack buttons and a *Scientific American* article regarding *Engineering*'s role in the Hughes microphone controversy. Cat. 1330:15, Batchelor (*TAEM* 93:229); see also Doc. 1396.

-1404-

To Stockton Griffin

Chicago Aug 21 1878[a]

S. L. Griffin

Leave for St Louis tonight and home Friday[1]

T. A. Edison

L (telegram), NjWOE, DF (*TAEM* 15:1065). Written by Griffin; letterhead of T. A. Edison. [a]"187" preprinted.

[1] That is, on 23 August.

-1405-

From George Bliss

Chicago Ills Aug 22 1878.[a]

Thos A Edison

Beetle writes= Edison has carried off the Grand prize, of the paris exposition=[1] Art= Industry= Mechanics etc each have a Grand prize but above all these is the great prize= the Grandest of all which Edison gets. Hold up on Beetle till you see me. Have sent prof Barkers pass

Geo H Bliss

L (telegram), NjWOE, DF (*TAEM* 15:1067). Telegram form of Western Union Telegraph Co. [a]"1878" preprinted.

[1] According to the *Scientific American Supplement* (6:2370), Edison was one of nine American individuals or companies awarded the Grand Prize at the Paris Universal Exposition. The prize ranked above the gold medals given to several dozen other Americans. Edison's Grand Prize was in recognition of his phonograph, telephone, and electric pen; Elisha Gray received the same honor, in part for his musical telegraph. On 6 August, George Beetle had written Edison about the bestowal of the Grand Prize, a letter that would have reached Menlo Park by this time. Beetle wrote again on 6 September, telling Edison that the award was given "not on any particular invention but as the inventor of the age in which we live" and would not be made public until 1 October. DF (*TAEM* 17: 588, 590).

-1406-

Anonymous Article in the New York Daily Tribune

ST. LOUIS, Aug. 23. 1878[1a]

MR. EDISON RECEIVED AS A MEMBER.

Announcement of the Honor Awarded Him at Paris—He Reads a Paper on Some of His Inventions.

Mr. Edison was formally presented to the Science Association as a new member by Professor Barker at the general session this morning. Professor Barker said that the time has come when the scientist is no longer the only discoverer; the practical man has found science too slow, and has stepped in and discovered for himself. It gave him great pleasure, he said, to introduce Mr. Edison to the association. Mr. Edison was enthusiastically received. Professor Marsh, in a brief speech of welcome, said it would be probably the most gratifying intelligence to the gentleman himself, as well as to the audience, to hear that the association had been informed this morning, by a telegram, that the Grand Prize had been awarded at the Paris Exposition to Mr. Edison for the most wonderful inventions of the age. A motion was made and carried that a committee of three be appointed by the chair, to arrange for a eulogy of the late Professor Henry. Professors Newcomb[2] and Baird,[3] of Washington, and Meyer,[4] of Hoboken, were appointed as such committee. The association then adjourned to meet in sections.

At half past 12 o'clock Mr. Edison read a description of his tasimeter and a new voltameter.[5] He also spoke of the principle involved in the microphone and the carbon telephone, and claimed to be the first one to use finely divided conducting material for the purpose of translating sonorous vibrations into electric waves.[6] Mr. Edison will leave the city to-night.

PD, *New York Daily Tribune,* 24 Aug. 1878, 2. In Cat. 1240, item 854, Batchelor (*TAEM* 94:337). [a]Date not that of publication.

1. The article carried this dateline and was printed as news of the third day's session of the meeting of the American Association for the Advancement of Science. It was followed by an article dated 21 August describing the first day's session. Both articles were carried under a general headline "Science at St. Louis."

2. Simon Newcomb was an internationally renowned mathematical astronomer stationed at the Naval Observatory. *DSB,* s.v. "Newcomb, Simon."

3. Zoologist Spencer Baird had been assistant secretary of the Smithsonian Institution since 1850 and succeeded to the secretaryship upon Henry's death. *DSB,* s.v. "Baird, Spencer Fullerton."

4. Alfred Mayer.

5. Docs. 1382 and 1401.

6. According to the 24 August *Chicago Tribune* (p. 3):

> Mr. E[dison] had four papers before Section "A," which he was expected to read, and when that section met, immediately after the adjournment of the regular session, a great crowd was present to see and hear him. His papers were "On the Use of the Tasimeter for Measuring the Heat of the Stars and the Sun's Corona," "On the Application of the Carbon Button as the Principle Involved in the Microphone," "The Carbon Telephone," and "A New Voltameter." Mr. Edison could only be induced to read one of his papers,—the first one mentioned. Prof. Barker read the other three for him, and a good deal of discussion followed all of them.

A full account of Barker's presentation on the carbon telephone and the carbon button is found in "A.A.A.S.," *St. Louis Globe Democrat,* 27 Aug. 1878; "American Association for the Advancement of Science," *Western Review of Science and Industry,* Sept. 1878, Cat. 1032:90, 107, Scraps. (*TAEM* 27:871, 898).

-1407-

To Stockton Griffin

Chicago Aug 24 1878[a]

S L Griffin
Will be home Monday[1]

T. A. Edison

L (telegram), NjWOE, DF (*TAEM* 15:1074). Written by Griffin; letterhead of T. A. Edison. [a]"187" preprinted.

1. That is, on 26 August.

-1408-

To Leslie Ward

Menlo Park, N.J., Aug 25 1878[a]

Dr Leslie D Ward
If convenient come down on early train tomorrow to see Mrs Edison

T. A. Edison per G[riffin]

L (telegram), NjWOE, DF (*TAEM* 15:575). Written by Stockton Griffin; letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted.

-1409-

To George Gouraud

Menlo Park, N.J., Aug 26 1878[a]

Gouraud[1]
You may have half of Telephone interest in England[2] just returned home from west. Telegraph Puskas that we send some other styles telephone soon Write Hilborne Roosevelt Paris that Puskas has full authority in matter[3]

Edison

L (telegram), NjWOE, DF (*TAEM* 19:902). Written by Stockton Griffin; letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted.

1. In a cover note directed to George Ward, Edison asked that the Direct United States Cable Co. transmit this to London "when convenient;" Stockton Griffin sent it at 5:30 P.M..

2. On 30 August, Gouraud cabled Edison asking him to forward his English telephone patent and to provide a copy of the Nottage contract.

He also inquired as to the price for one hundred telephones without batteries. In reply the following day, Edison indicated that he would send the Nottage contract but asked Gouraud to purchase a copy of the patent there. Edison also stated that a complete telephone station cost twenty dollars. Gouraud subsequently discovered that it would be three months before he would be able to obtain a copy of Edison's telephone patent in England and cabled Edison on 9 September to ask him to request his English patent solicitors to provide a copy. DF (*TAEM* 19:906–7, 912).

3. On 24 August, Roosevelt had cabled Edison to ask if he would "accept twenty five Thousand dollars cash Telephone France and Russia Puskas refuses he is bound to Bailey." DF (*TAEM* 19:899).

-1410-

From William Barrett

MONKSTOWN.[a] Co[unty]. Dublin Aug 26 [1878][1]

Dear Sir,

You may possibly have seen my articles in Nature[2] & Good Words[3] &c. a copy of the latter I send by this mail[b] ~~in~~ on your discoveries, if not I will send them to you if you will allow me. Having been asked to deliver the opening lecture at the chief ~~midl~~ Scientific Institute in the Midland Counties of England "The Midland Institute" at Birmingham on Sept 30,[c] next, & also at the well known London Institution in Decr & the Royal Institution at Hull in Jany, I have selected the ~~follo~~ title of "Mr Edison & some of his Discoveries":— I am therefore anxious to bring before the public here an epitome of your work with Experimental illustrations. If you will kindly aid me in this I shall be deeply obliged, as my lectures will be ~~noticed in~~ briefly reported in the London Times & more fully in the provincial papers, & subsequently republished[4] I am anxious to have the[d] latest & fullest information. Can I show your "tasimeter" & your "telephone"?[5] I hope to arrange for the phonograph with the Stereoscopic Company[6] Believe me Yours truly

(Professor) W. F. Barrett[7]

If you have an agent here perhaps you would instruct him or could I procure from you direct the instruments named.

ALS, NjWOE, DF (*TAEM* 15:1080). [a]"MONKSTOWN." preprinted. [b]"a copy . . . mail" written in left margin with indication to insert it here. [c]Underlined twice. [d]Obscured overwritten letters.

1. Stockton Griffin supplied the year in a copy he made of this letter. DF (*TAEM* 15:1083).

2. Barrett (1878a) reviewed the telephonic work of Philip Reis and proclaimed at the end

> it is unlikely the telephone of the future will employ the voice to generate the driving power, but only to modulate the flow of a current obtained by coarser means. It is in this direction that Reis worked, and though his method was faulty in the employment of an intermittent current, the same cannot be said of the arrangements adopted by Mr. Edison, of New Jersey. And inasmuch as Mr. Edison has already discovered and brought to a practical issue such remarkable additions to our knowledge as quadruplex telegraphy, the electro-motograph, and the phonograph, we have, in these achievements, the earnest of success to those excellent telephonic investigations wherein Mr. Edison has already won an enduring fame.

In this article, Barrett also included a lengthy footnote—part of the prominent public debate about spiritualism, mesmerism, and science—in which he used Edison's discovery of the phonograph to challenge the epistemological standards recently propounded by the noted physiologist William Carpenter, a strong critic of all proposed evidence of spiritualist phenomena (Carpenter 1877; Kottler 1974, 179).

3. Barrett 1878b. In this article Barrett discussed the phonograph and experiments conducted with it by British scientists as well as reports of the capabilities of Edison's more recent models. He also included illustrations drawn from other publications and the image of Edison alone with the phonograph taken at Mathew Brady's studio.

4. Reports on the Midland Institute Lecture appeared in *Nature* (18 [1878]: 630) and the *London Times* (8 Oct. 1878, 7). Baldwin (1925, 30) mentions that Barrett gave his lecture to the London Institution in December 1878, but mistakenly credits this as the introduction to the British public of the Edison carbon transmitter.

5. See Doc. 1453.

6. In his article in *Good Words,* Barrett noted that "through the obliging kindness of the London Stereoscopic Company" he had "had the opportunity of making a series of experiments with a very perfect instrument" (Barrett 1878b, 562). However, see Doc. 1645 concerning his subsequent difficulties in obtaining phonographs for his lectures.

7. William Barrett (later knighted) was the physics professor at the Royal Dublin School of Science and a founder of the Society for Psychical Research. *WWW* 2, s.v. "Barrett, Sir William Fletcher."

-1411-

From George Nottage

Sandown Isle of Wight Aug 26th 1878.

Dear Mr Edison,

I have had your letter of the 2nd inst sent to me here, and I have now the pleasure of sending you the "pamphlet" asked for.[1] You will find it a collection of the various articles upon your Instrument.

It is a very remarkable circumstance that tho' we have had orders out for the Superior Insts. for many months we have not yet had a delivery the makers not succeeding in making them perfect. We are however promised some almost immediately.

We have sent out the Inst to Liverpool & other towns but I am sorry to say that the expenses have been more than the Receipts. We have however obtained several orders.

I should be much obliged to you, if you could send me over a sample of one which could be produced cheaply by you for our Christmas Trade. Of course it would be wanted as soon as possible to order from. It appears to me that in America your perfection of machinery is so great that you can produce the screw so much more perfect at a low price, than our men can. It ought to be a nice looking Inst. The one sent before was rather rough— I think if the point & mouthpiece[a] ~~wer~~are fixed on a piece of metal which works in two grooves, it is better than the old arrangement.

I am sorry to see there has been such a difference between you & Mr Preece and Mr Hughes. I cannot myself decide upon the abstract merits of the case between you. My firm has had some of the small Microphones but they have not done 5£ worth of sales in them— Bell's Coy have fixed such a heavy prices upon their Telephones that they are almost prohibitive.

I hear you have been inventing some extraordinary Insts lately exciting the wonder of the Scientific world. I trust you will be able to perfect them, and if there are any of them we can work commercially I shall be happy to do so.

I am Dear Mr Edison Yours faithfully

George S Nottage

PS We had the Phono. shewn[b] at the British Assn for Advancement of Science in Dublin. It created great interest.

ALS, NjWOE, DF (*TAEM* 15:1076). [a]"& mouthpiece" interlined above. [b]Obscured overwritten letters.

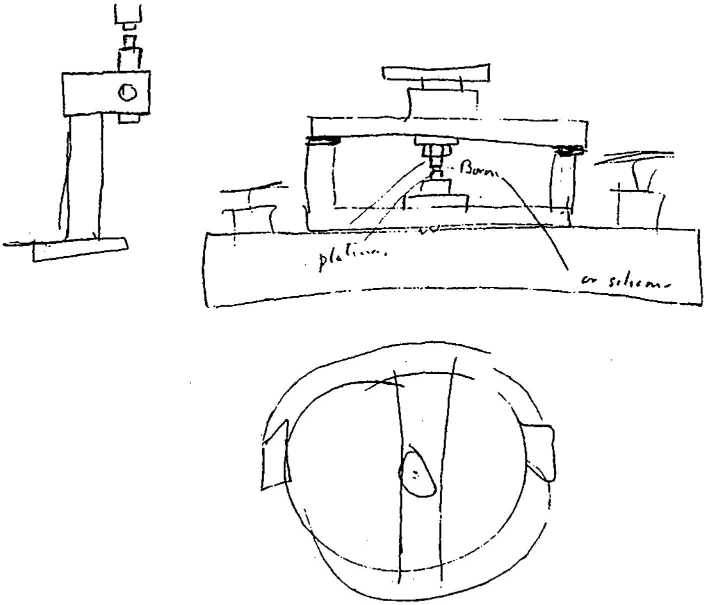
1. Edison had asked Nottage to "please favor us with a pamphlet published by the London Star on the Phonograph." This item has not been found. 2 Aug. 1878, Lbk. 3:327 (*TAEM* 28:768).

-1412-

Technical Note: Electric Lighting

[Menlo Park,] August 27, 1878

Electric Light[1]



T A Edison
J Kruesi

Chas Batchelor
Stockton L Griffin[2]
M N Force

X, NjWOE, Lab. Vol. 16:6 (*TAEM* 4:485). Copied by William Carman in Cat. 994:117, Lab. (*TAEM* 3:227).

1. The text in the drawing is "platina," "Boron," and "or silicon." This is the first dated evidence of Edison's work on electric lighting following his return from the West. It is similar to his efforts on this subject in September 1877 (see Docs. 855 and 1044). He discussed those earlier experiments in an undated note, apparently from 1877:

> If a small peice of Silicum be placed between the carbon points of an electric light and a weight be placed upon the upper vertical carbon, the passage of the current will heat the Silicum and cause the electric arc to appear This continues indefinitely, the silicum preserving the continuity of the arc both by its Conductivity, and by its presence as a seperator of the two carbons. I have only tried it with elements of high internal resistance. Boron does not answer so well. [Undated Notes and Drawings, Menlo Park Period, Lab. (*TAEM* 45:128)]

The account entry labeled "Electro Silicon Light," which began on 30 August and continued into the second week of October, would have included lamps of this design (Cat. 1185:61, Scraps. [*TAEM* 22:587]).

2. Stockton Griffin, who was a notary public, embossed with his seal

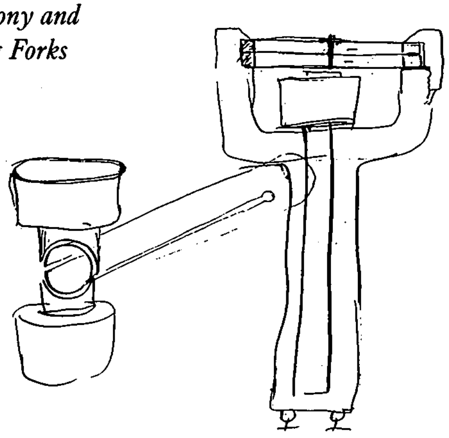
and signed certain laboratory notebook entries between the end of August and the second week of October 1878. He marked many others with a stamp that said, "Personally appeared before me this day of 18 , the said Thos. A. Edison, Chas. Batchelor, John Kreusi, and Martin Force, and acknowledged the above to be their signatures. Notary Public." He signed very few of the stamped pages and never filled in the blanks.

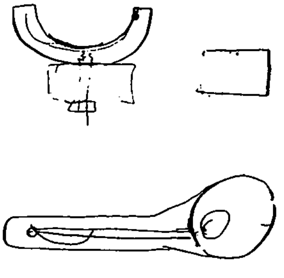
-1413-

Technical Note: Telephony and Tuning Forks

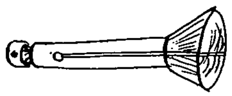
[Menlo Park,] Aug 29, 1878.

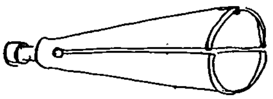
Telephone

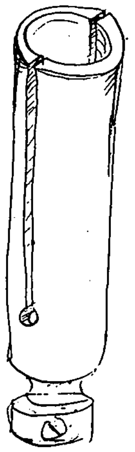




Resonant Tuning fork.[1]







Funnel fork.

T A Edison

J Kruesi

X, NjWOE, Lab., Vol. 14:146 (*TAEM* 4:303).

1. At the August 1879 meeting of the American Association for the Advancement of Science Edison presented a paper on this resonant tuning fork. The published abstract provides the following description:

> For the purpose of rendering audible the sounds produced by tuning forks, they are generally mounted upon resonant boxes containing a column of air whose vibrating period is the same as that of the fork. I have devised a modification of this plan, by which the box is dispensed with, the resonant chamber, as is shown in the cut, being formed by the prongs themselves. To make the fork, a thick tube of bell-metal, one end of which is closed, has a slit sawed longitudinally through its center, the slit being nearly to the closed end. This slit divides the tube equally and gives two vibrating prongs, analogous to those of a fork. To bring the prongs into unison with the column of air between them, the tube is put in a lathe and turned thinner until the desired point is reached and the two are in unison. Thereupon the sound of the fork is powerfully reinforced. [Edison 1880, 178]

Edison apparently had John Kruesi make the fork following his return from the West. NS-78-001 and NS-78-010, both Lab. (*TAEM* 7:732, 899).

-1414-

Draft to William Wastell[1]

Menlo Park, N.J., Aug 31 1878[a]

Dr Sir

I~~n~~ understand that Wm P Edison still continues to run opposition to the road.[2] I have ~~repeatedly~~ complained to him of the injustice of running opposition to a road in which I am the largest stockholder but to this he replies that he must ~~live.~~ make a living. It does seem to me that this ~~spite business~~ personal feeling[b] on the part of our people out there has not nor never will pay: In my opinion the best thing is to buy him off ~~consoli~~ by giving him a position ~~in the road~~ that will at least give him a living & secure his services cooperation and stop all further trouble. What say you.

T A Edison

DfS, NjWOE, DF (*TAEM* 19:403). Letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted. [b]"personal feeling" interlined above.

1. William Wastell, a Port Huron druggist, was one of the original organizers of the Port Huron and Gratiot Street Railway. Jenks n.d., 2, 4, 7; *History of St. Clair County, Michigan* 1883, 585–86.

2. The Port Huron Railway Co. had been formed in January 1877 when the Port Huron and Gratiot Street Railway and City Railway merged; Edison held 158 shares in the company (see *TAEB* 3:575 n. 1; Docs. 841 and 1148). In late 1877 his brother Pitt had "started an omnibus and baggage waggon" that cut "into the earnings of the road from

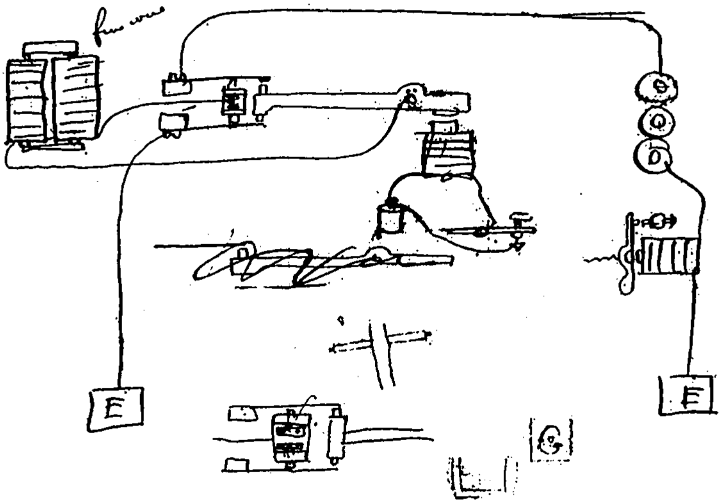
11 to 12 dollars pr day" (Wastell to TAE, 10 Nov. 1877, and see 12 Feb. 1878, both DF [*TAEM* 14:599; 19:385]). According to Antoine Marontate of the Port Huron Railway, Pitt was still running his omnibus in late May and soliciting passengers from the Chicago and Lake Huron Railroad, where Pitt's son Charles was working in the ticket office. Marontate, who asked for Edison's advice regarding Pitt's opposition, also claimed that because of the belief that Pitt was still connected with the Port Huron Railway, many in town "give their baggage to his man thinking it is all one." In mid-July, Marontate sent Edison a six-month financial statement of the Port Huron Railway and, though he did not mention Pitt by name, indicated that the opposition "are running two waggons all the time which takes considerable from us" (Marontate to TAE, 23 May and 12 July 1878, both DF [*TAEM* 19:397, 401]).

-1415-

Patent Model Specification: Multiple Telegraphy

[Menlo Park,] Aug 31 1878

Model[1] ⟨Way duplex[2]⟩[a]



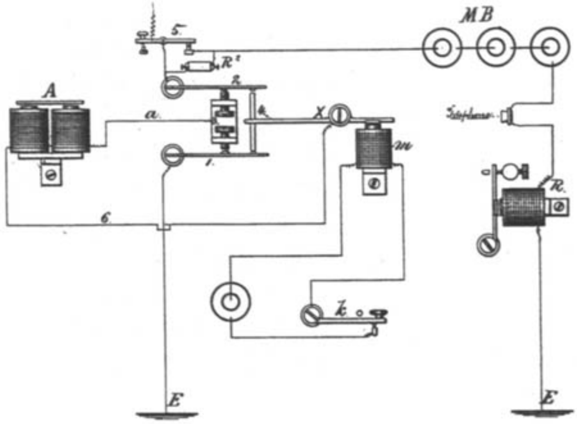
T A Edison

Chas Batchelor
John Kruesi

X, NjWOE, NS-78-010, Lab. (*TAEM* 7:900). Letterhead of T. A. Edison. [a]Written in an unknown hand, possibly by John Ott.

1. Text is "fine wire." This model order was for a patent application that became Edison's case 160, executed on 11 November 1878. After initial rejection, due to improperly phrased and overly vague claims, Edison amended the application, which issued in July 1879 as U.S. Patent 217,782, assigned to Western Union Telegraph Co. Additional instructions (not found) must have specified modifications in the ultimate model so it would match the circuit illustrated in the finished application. An account entry for the patent model, dated 6 September, is in Cat. 1185:218, Scraps. (*TAEM* 22:654); the model is at the Edison Institute.

Edison's way duplex patent drawing (U.S. Pat. 217,782).



2. This patent model drawing is part of Edison's recurring work in the field of multiple telegraphy, a concern stretching back to his earliest inventive years. It shows only selected aspects of a design that would allow use of a portion of a telegraph line (that is, between way stations) for one message while the whole or a larger part of the line was simultaneously in use for another message. The key feature was a transmitter (shown in the center of the diagram) that created an electrical signal by reversing the connections without breaking the circuit of an electromagnet (shown at left) in a line that always had current in it. Because this would neither change the basic current strength nor reverse the current, it did not affect either ordinary or polarized relay receivers used on the main line, but would be readily detectable by a telephone receiver (not shown) placed at the way stations. While Edison had determined enough of the design to start the construction of the patent model with this sketch, over the next few days he considered alternative arrangements, including the use of an induction coil instead of a regular electromagnet, before settling on the design shown in the patent (see NS-78-010, Lab. [*TAEM* 7:901]). Starting in 1885, Edison developed a commercially valuable system, called the Phonoplex, that was very closely related to the designs noted here (U.S. Pat. 333,289; *TAEM-G2–3*, s.v. "Edison Phonoplex System").

For clarification of the basic requirements of duplex telegraph designs, and an overview of Edison's continuing work in the field and his interest in the problem of way stations in such systems, see *TAEB* 1:31–32, 3:280–82, and Docs. 282–83, 285, 348, 392, and 485.

STANDARD MODEL EXHIBITION TINFOIL PHONOGRAPH Doc. 1416

Development work by Batchelor and Edward Johnson led to the final form of the commercial tinfoil phonograph by the end of August. It was based on the new large flywheel phonograph Edison and Batchelor had designed during June (Doc.

1369), which Batchelor modified after Pool & Company delivered ten of these instruments in mid-August. The design also incorporated changes made by Johnson to the old exhibition machines then being sold by the Edison Speaking Phonograph Company. They completed the design after Edison returned from his western trip in late August, and by the beginning of September, Johnson was exhibiting one of the new phonographs in New York.[1]

Among the most important design changes Batchelor made in the Pool & Company phonographs was the redesign of the mouthpiece arm. Rather than placing this arm on a lever that swiveled horizontally away from the cylinder, he mounted it on a base that allowed the arm to pivot vertically down and away from the cylinder. To permit the operator to place the stylus more precisely he also placed two side-adjusting screws on the base, described as "centre screws for moving the mouth-piece to the right or left, as may be required to bring the stylus to a position *exactly in the centre of a groove*." The final design also included "a screw for regulating the depth of the groove made in the record foil by the stylus."[2] Batchelor decided to move the threaded part of the throw-out from the back of the shaft to the bottom, "because it helps to hold up the shaft and probably makes it run easier."[3] Finally, the revamped instrument used a simple rubber-covered steel rod to crimp the foil into the slot cut across the cylinder, replacing the slide-mounted bar on the Pool & Co. phonographs.[4]

Johnson's principal contribution was "an adjustable Mouthpiece & Dampener combined" so that "a given adjustment which talks low can be made to 'speak right out in meeting'—by simply easing up or tightning the adjustment." According to the directions that came with the machine, an operator could dampen the vibrations of the diaphragm by turning "the mouth-piece to the right by small degrees, until the movement of the stylus is perceptibly diminished." Though the proper adjustment might require some experimentation, Johnson claimed that his design "renders but the work of a moment that which heretofore required even of me with my experience from 15 to 30 minutes." The company claimed that "when properly adjusted the Phonograph will speak loud enough to be distinctly heard by an audience of from three to five thousand people."[5]

The Edison Speaking Phonograph Company planned to offer two models. The first was an "exhibition instrument" made entirely of iron except for the brass cylinder "grooved with twenty-four threads per inch." The second was a fine "drawing room instrument" with a cylinder having forty threads per inch that gave it "nearly double the recording surface on a cylinder of the same size." The company claimed that this also "adds a trifle to the distinctness of the articulation, and approximates more nearly the quality of the voice." The drawing-room instrument was made entirely of "brass, hand-filed and beautifully finished throughout. The fly-wheel, base, etc. being of brass, the instrument is given a rich appearance. It is mounted upon a handsome rosewood and inlaid box, with drawer for tools"; the iron machine was mounted upon a "neat white wood box," which also had a tool drawer. Besides tools and materials for repair and adjustment, each machine came with a set of instructions, six styli, five pounds of tinfoil, and "a funnel for increasing the volume of sound in the reproduction." All of these phonographs were manufactured by S. Bergmann & Company, which also supplied the tinfoil.[6]

When the first fine brass machines were ready in mid-October the company began offering "three styles of Phonographs for exhibition purposes,—one of iron at $100; one of higher finish with brass mountings at $150; and the last entirely of brass at $200."[7] During the rest of the year, only one of the all-brass machines was sold. This was listed in the November royalty report as a "Brass Machine" and is probably the "1 Extra Brass Phonograph" manufactured by Bergmann & Co. in October for ninety dollars with supplies. Bergmann & Co. did manufacture five "Fancy Brass Phonographs" for eighty-five dollars in November and another two in early December. Although Johnson claimed on 9 December that he had sold six of them, royalty reports list only one sold in January and another in March 1879.[8]

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1. See Docs. 1419 and 1421 n. 1.

2. This design change was apparently made by 23 August, the date of an account entry for an "Improved Hand Phono Swing dia[phragm] Bracket." Cat. 1185:289, Accts. (*TAEM* 22:683); Vol. 17:136–38, Lab. (*TAEM* 4:1000–2); Johnson 1878, 3–5.

3. Vol. 17:135, Lab. (*TAEM* 4:999); Johnson 1878, 3, 6.

4. This simplified crimping design dated from 26 June. It is unclear whose idea it was. The drawing, which may be by John Kruesi, is signed by Edison, Batchelor, and Johnson. Vol. 17:128, Lab. (*TAEM* 4:993).

5. Johnson to Uriah Painter, 6 Aug. 1878, UHP; Johnson 1878, 2, 5.

6. Johnson 1878, 1–2, 4; S. Bergmann & Co. circular, 22 Oct. 1878, Box 4, UHP.

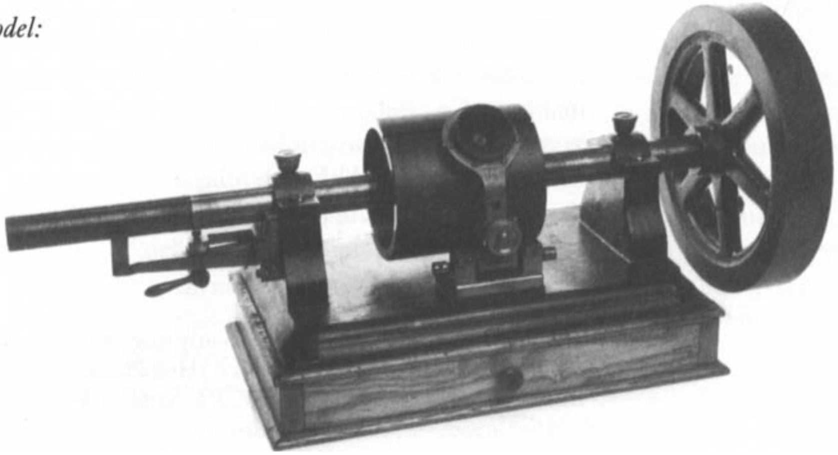
7. Charles Bailey to Wm. Harmon, 12 Oct. 1878, ESP Lbk. 3:377,

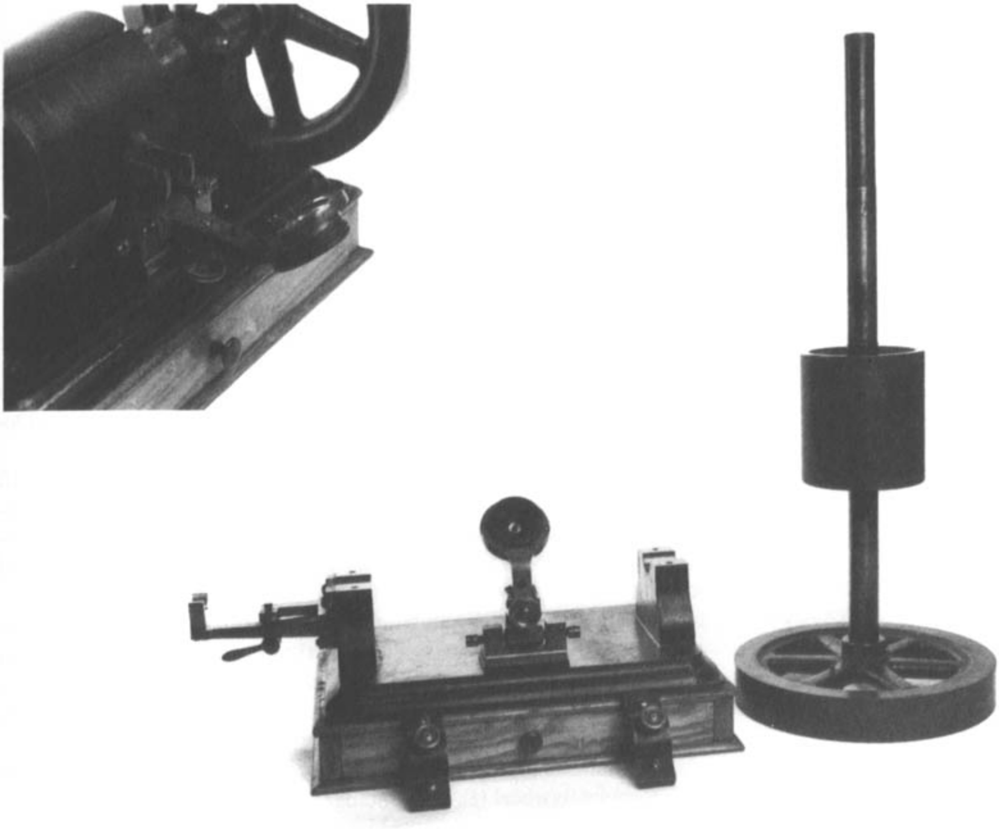
UHP. There are apparently no extant all brass machines but one of the bases for them survives. The company seems to have sold four different machines. The all brass machine sold for $200 and the all iron machine for $100. There were two intermediary machines, one cost $125 and had an iron cylinder and mouthpiece holder but included brass adjusting screws and a brass endpiece on the throwout mechanism while the other sold for $150 and included a brass cylinder, mouthpiece and holder, oil cups, adjusting screws and throwout mechanism. Extant machines, all labeled "Experimental apparatus for illustrating the principle of Edison's speaking phonograph, patented February 19, 1878. Manufactured by S. Bergmann & Co.," can be found in the United States at the Henry Ford Museum and the Museum of American History, Smithsonian Institution. The Edison National Historic Site has a related experimental model. Edison Speaking Phonograph Co. royalty statements for October–December 1878, DF (*TAEM* 19:198, 201, 204).

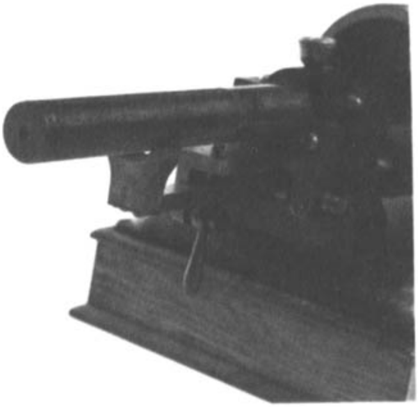
8. The other brass instruments (with supplies) cost sixty dollars to manufacture. The improved iron machines actually cost forty-five dollars with supplies, five more than the old style, but Johnson agreed to bear half the loss and the company paid $42.50 for them. Doc. 1609; Bergmann & Co. bills to Edison Speaking Phonograph Co., 7 and 15 Oct., 19 and 26 Oct., 2 and 30 Nov., and 7 Dec. 1878, all Box 4, UHP; Edison Speaking Phonograph Co. royalty statements for October–December 1878, January 1879, and March 1879; and Johnson to TAE, 5 Feb. 1879, all DF (*TAEM* 19:198, 201, 204; 51:694, 703, 692).

-1416- [Menlo Park, August 1878][2]

Production Model: Phonograph[1]



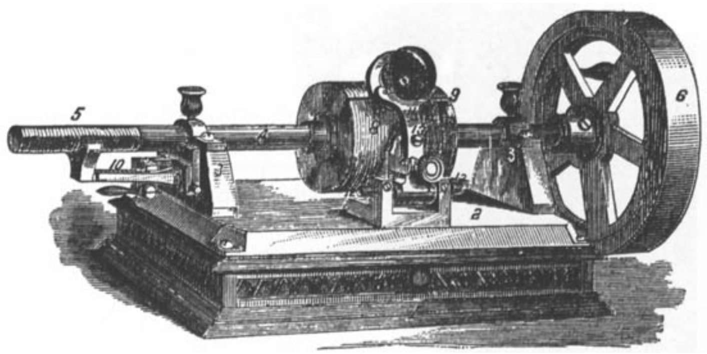




M (76 cm × 29 cm × 32 cm), Hummel.

1. See headnote above.

2. This phonograph is numbered 114. The design was settled in August, and this particular machine evidently was made sometime during

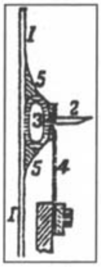


A tinfoil phonograph with a deluxe base shown in the instruction pamphlet from early Fall 1878.

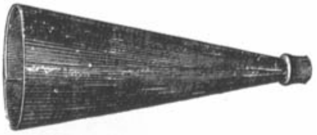
the fall—A. R. C[runu?] (otherwise unidentified) bought it for $125 in December. Edison Speaking Phonograph Co. royalty statement for December 1878, DF (*TAEM* 19:204).

This is an intermediate model; the thread on the cylinder and shaft is twenty-four turns per inch, rather than forty, while the base and supports are of iron and only a few parts are brass. The shaft, with the recording cylinder and flywheel, can be removed by taking off the tops of the journals.

The initial design, as illustrated in the company's instructions, employed a five-spoke flywheel, following the example of the phonographs delivered to Menlo Park in August (Doc. 1369). This machine's flywheel, however, has six spokes, as do other known examples (see headnote above, n. 6). An undated photograph at the Edison National Historic Site shows that at least one of the phonographs was produced with a five-spoke flywheel (ENHS photograph # 29.150/22).



A cross-section from the 1878 instructions showing positions of the: (1) mica diaphragm, (2) needle, (3) rubber tube, (4) steel spring, and (5) wax.



A funnel for directing and magnifying sound reproduced by a demonstration phonograph.

Some parts of the original phonograph are missing: the wax and rubber damping arrangement (for the diaphragm, needle, and spring), the flywheel handle, and the funnel. The original steel needle has been replaced with one of sapphire.

-1417-

Memorandum: Canadian Telephone Rights

Menlo Park, N.J.,[a] [August 1878?][1]

Release from Badger to Edison giving up all claims agreements etc on payment of $1,000.

Contract between Edison & G&Stock Co [-][b] to pay a yearly royalty of one dollar to Edison on each Carbon Telephone instrument ~~sent to Canad~~ used in Canada during life of patent.[2] G.&.Stock Co to pay the $1000 which goes to Badger

AD, NjWOE, DF (*TAEM* 19:905). Letterhead of T. A. Edison. [a]"Menlo Park, N.J." preprinted. [b]Canceled.

1. In September 1877, Franklin Badger, superintendent of the Montreal Fire Alarm System, had acquired exclusive rights to Edison's telephone inventions for Canada. In May 1878, Edison asked him to transfer these rights to Gold and Stock Telegraph Co. Badger at first sought to retain rights to the city of Montreal, and offered the rest of Canada for $2,500, with $500 going to Edison as a commission. By the end of August he had agreed to a complete transfer for $1,000 and he and Edison discussed the possibility of transferring the rights for $1,200, with Edison receiving $200. The release was finalized in late November and sent to Badger for his signature; he received $1,000. *TAEB* 3:549 n. 1; Badger to TAE, 16 May, 22 June, 15 July, 30 Aug., and 4 Nov. 1878, and 18 Jan. 1879; George Walker to TAE, 19 Oct. and 23 Nov. 1878, all DF (*TAEM* 19:853, 863, 874, 904, 952, 972, 979; 52:172); TAE to Badger, 29 Sept., 9 and 16 Oct. 1878, Lbk. 3:384, 397, 419 (*TAEM* 28:819, 831, 851).

2. George Walker, vice president of Gold and Stock, was negotiating with Edison regarding this matter. Walker also served as president of American Speaking Telephone Co., and the first Edison assignment of his Canadian rights was to this latter company on 15 October. However, on 21 January the assignment was made instead to Gold and Stock. Agreements of 15 Oct. 1878 and 21 Jan. 1879; Walker to TAE, 24 Jan. 1879, all DF (*TAEM* 19:942; 52:180, 184).

-5- September 1878

After Edison returned from the West, George Barker arranged a visit to William Wallace's shop in Ansonia, Connecticut, to see his electric light and power experiments. On Sunday, 8 September, they traveled by train to Ansonia, accompanied by Charles Batchelor, Columbia University professor Charles Chandler, and a reporter for the *New York Sun.* Of particular interest to them was the electrical generator that Wallace called a "telemachon," which he had developed together with noted electrical inventor Moses Farmer. Wallace hoped to use the machine to transmit power electrically over a great distance, something that Edison had discussed with Barker in connection with western mining. According to the *Sun* reporter:

> Mr. Edison was enraptured. He fairly gloated over it. Then power was applied to the telemachon, and eight electric [arc] lights were kept ablaze at one time, each being equal to 4,000 candles, the sub-division of electric lights being a thing unknown to science. This filled up Mr. Edison's cup of joy. He ran from the instruments to the lights, and from the lights back to the instrument. He sprawled over a table with the simplicity of a child, and made all kinds of calculations. He calculated the power of the instrument and of the lights, the probable loss of power in transmission, the amount of coal the instrument would save in a day, a week, a month, a year, and the result of such saving on manufacturing.[1]

The *Sun* article reported that Edison planned to "so assist Mr. Wallace in perfecting the telemachon that power may be transmitted from one point to another as though it were a telegraphic message," and Wallace promised to send Edison one of his machines. In fact, the visit spurred Edison's experiments on incandescent electric lighting. Though he had experimented occasionally with arc and incandescent lights during the past year, it was at Ansonia that he "saw for the first time everything in practical operation. It was all before me. I saw that the thing had not gone so far but that I had a chance. I saw that what had been done had never been made practically useful. The intense light had not been subdivided so that it could be brought into private houses."[2]

After only a few days' work Edison had drafted a caveat and wired Wallace to "Hurry up the machine I have struck a big bonanza." This was apparently his plan to use a regulator that would prevent the metal burner in his lamp from reaching its melting point and extinguishing its light. Because the regulator temporarily removed the lamp from the circuit, he also realized that to operate any number of lamps they had to be placed in parallel circuits so that each individual lamp could be turned on and off without affecting the others. This was also desirable for customers used to independently operated gas lamps. On 16 September, he announced in the pages of the *New York Sun* that he had solved the problem of "subdividing" the electric light "through an entirely different process than that from which scientific men have ever sought to secure it" and described his plans to develop a system of electric lighting to replace gaslighting.[3]

With this pronouncement Edison committed himself to developing a commercial incandescent lighting system, and also attracted the attention of potential investors in his effort. Several Western Union directors began to suggest the possibility of forming a company to exploit his ideas. Grosvenor Lowrey, who acted as the company's corporate attorney, became Edison's advisor and principal negotiator with these and other prospective investors. While Lowrey conducted negotiations, Edison continued to experiment and at the end of September he drew up his second electric light caveat.

As the electric light began to engage most of Edison's attention, he did little work on other inventions. He relied on his nephew Charley to develop a new telephone receiver based on Edison's earlier ideas and experiments regarding an electromotograph receiver. In France, Theodore Puskas finalized a combination of Edison's telephone interests and those of Elisha Gray, who was represented by Joshua Bailey. Together with French merchant Georges Godillot, they agreed to set up a company to exploit the two inventors' telephone patents. Meanwhile, in London, George Gouraud was busy attempting to form companies to exploit Edison's telephone in Britain. He also assisted James Adams in his experiments to communicate by telephone between France and Britain over a telegraph cable. At the end of September, Edison filed his preliminary statements for the Telephone Interferences.[4]

The exploitation of the improved phonograph developed during August was left to Edward Johnson, who began exhibiting it in New York. Johnson's exhibition included other Edison inventions as well and was intended as the model for a touring exhibition scheme proposed by James Redpath, though nothing further seems to have come of it. Plans to place a toy phonograph on the market, which Uriah Painter urged Edison to oppose as an infringement of the Edison Speaking Phonograph Company's patent rights, also came to nothing. Although Edison finally executed two patent applications for the plate and cylinder clockwork designs that he had featured in his May foreign patent applications and U.S. caveat, he did not actually file them for over a year.[5]

Edison sought to market other new inventions as well. He arranged with scientific instrument maker John Browning in England and with Partrick & Carter in Philadelphia to manufacture his tasimeter, though he declined to accept a royalty "on instruments of a purely scientific character."[6] In late August and early September, he developed a chimneyless kerosene lamp in which an electric engine created the draft. However, it was never marketed by Orson McCall, who had asked Edison to design the lamp.[7] Concerned over the fate of such inventions, Edison proposed to George Bliss that they form a company to "take my small inventions, like the E pen and auriphone &c, and find a market for them."[8] Though Bliss proposed the formation of the Edison Merchandising Company, the basis of which would be the electric pen business, nothing came of this plan. Instead, Edison left his acoustic inventions, including the auriphone (his hearing aid), under the control of Painter.[9] Bliss, who had acquired the phonograph agency in Illinois, also continued in charge of the electric pen. To protect the latter business he actively pursued infringers and got Edison to agree to bring suit against one of them.

In mid-September, when a grand jury convened in New York to consider indictments against the Metropolitan Elevated Railroad, Edison was not ready to testify. He wanted more time to analyze the sound recordings he and Batchelor had made of noise on the railroad's lines. Although Lowrey urged him to testify anyway, he did not do so.

Immediately after his return from the West, Edison had instituted a new record-keeping practice at the laboratory: Stockton Griffin marked laboratory documents with his notary stamp or embossing seal. In late September, he also had William Carman copy certain documents into the Experimental Research notebooks. Both of these practices continued into the fall but were abandoned by year's end.[10] There were also additions to the laboratory staff. Telegrapher John Knight began to assist with electrical experiments, while N. Ruffner, who came at the very end of August, briefly assisted with chemical experiments. At the very end of September, Edison hired Arthur Andrus to help make carbon buttons for the telephone transmitter, which the laboratory was supplying to the manufacturers.[11] One other addition to the laboratory was the small wooden photographic building constructed in September.[12]

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1. The 10 September *Sun* article, "A Great Triumph," was reprinted the same day in the *New York Mail,* which Charles Batchelor put in a scrapbook (Cat. 1241, items 878, Batchelor [*TAEM* 94:349]).

2. "Edison's Electric Light," *New York Sun,* 20 Oct. 1878, Cat. 1241, item 963, Batchelor (*TAEM* 94:382).

3. Doc. 1439.

4. TI 1:vii–xx (*TAEM* 11:13–20).

5. Edison drafted the applications in August and Serrell finished preparing Cases 154 (clockwork cylinder phonograph) and 155 (disk phonograph) by the beginning of September (Serrell to TAE, 1 and 8 July 1878, Serrell bill to TAE, 1 Sept. 1878, DF [*TAEM* 18:721, 724, 741]; TAE to Serrell, 8 July 1878, Lbk. 3:320 [*TAEM* 28:761]). A copy of Case 154, which Edison executed on 16 September is in DF (*TAEM* 18:758); the drawings for both cases are in Patent Application Drawings (*TAEM* 746–53). The required patent models, which had been completed in June, were used instead with a Canadian application (Cat. 1185:218, Accts. [*TAEM* 22:654]; Serrell to TAE, 10 Dec. 1878, DF [*TAEM* 18:841]). New models for the U.S. applications were not provided until sometime in 1879 and the applications were filed on 15 December (Serrell to TAE, 9, 14, and 29 May 1879, DF [*TAEM* 51: 486, 489, 496]; Abstract of Edison's Abandoned Applications, Patents [*TAEM* 529–30]).

6. Doc. 1444.

7. Doc. 1442.

8. Doc. 1464.

9. Regarding Painter's involvement with these inventions see Docs. 1245, 1250, 1298 n. 2, 1326, and 1388 n. 10.

10. Doc. 1412 n. 2; Cat. 994:114–204; Cat. 996:75–97, 175–83; Cat. 997:48–93; all Lab. (*TAEM* 3:226–272, 316–27, 332–48, 376–98).

11. On Knight see Doc. 1572 n. 2; on Ruffner and Andrus see their timesheets, DF (*TAEM* 17:690, 699, 708, 715, 724).

12. Cat. 1185:195, Accts. (*TAEM* 22:645).

-1418-

From James Adams

London Sept 2d 1878

Dear Sir

Tried some experiments just before I left Paris[1] for some invited people by Puskas & Baily which is needless to say was O.K. got four French Papers with articles about telephones, which calls our tels the Gray-Edison, I called Baily to account about it when the following conversation took place between me and him

Showed him papers and asked him if he had anything to do with it

No I had nothing to with giving it that name, nor am I the cause of having them published

Do you think it is right or is it giving justice to Edison

No it is not right but we cant help these things getting in to the local papers.

All right you know as well as I do if I was to publish the truth concerning the tests made with the telephones it would bust you deader than hell, but as you and Puskas is together in this thing and going to make a big haul out of it, I have refrained from doing it, but as you say you had nothing to do with it and it is not right that such things should appear in the press, you will have no objections to me contradicting it and puting matters straight

Oh dont do that it has only appeared in local papers and it will never be known outside of Paris and if you go and say anything now it will show that there is ill feeling amongst us and hurt us with the people that we are negotiating with

Yes it would hurt you this far that they would not have anything to do with your telephone at all and you would be left out in the cold[a]

then he went to Puskas and told him to talk with me about it, for Adams was so thin skined about those little matters, that he might take it into his head to contradict it, and he would do it in such a way that our people would think that there was something wrong & might bust us compleatly. he feels in a devil of a way about it, and I intend to keep him that way.

now look here Edison Baily has spent a good deal of money for newspaper pufs, I think there was one sent to you which was all Gray, and mighty little Edison[2] and in each and every case the Gray has never been shown[a]

I denyh that the Gray tel. was ever shown to any of the Party that intends to buy it, nor to any newspaper men nor to the Public

The Philps[3] telephone was tried ~~the~~ at the first tests that was made but it was so low that they would never show it any more on a line

but they show it on a wire 300 yards long double wire, and ours is all the time on the long circuit but the comparison is so great under those conditions that no one wants to hear it. it's so dark that I cant see to write anymore

Americans that has just come over say that the Edison telephone works better in France than it does in N.Y.

Address as usual to Paris Yours truly

Jim

ALS, NjWOE, DF (*TAEM* 19:908). [a]Followed by centered horizontal line.

1. Adams had left by 29 August, when Gouraud wrote that he was in London "putting up telephones." Gouraud to TAE, DF (*TAEM* 19:903).
2. This clipping has not been found.
3. He meant Phelps.

-1419-

From William Wheeler

Detroit, Sept. 2nd 1878.[a]

Dear Sir:

I enclose, herewith, a little cutting from the Telegram of this city, and which, undoubtedly, has been in circulation throughout the country to the great detriment of the poor devils who's misfortune it has been to exhibit the Phonograph.[1] Of course I do not know if you have said any thing of the kind, but if you have, or have not, it has done us very great mischief. I have had to apologize and say that you have[b] said nothing of the kind, & when they[b] insisted you had said so— I have had to say in the blandist French that it was "a d——d— lie," that my machine was better than any you had & by such "bulldozing" made them believe you never said any such thing— That some of the machines have been most horrible & still more horribly operated then has been no question but there has been[c] some redeeming ones. Mine has never failed to give satisfaction. It is one of the first that Bergman made with flywheel.[2] The papers have stated that you have made wonderful improvements & from some of the stories one is made to believe, you have only to look your thoughts and the Phono. will speak them out—[3] Now if you have any great & wonderful improvements what are they? & are they so simple that I can attach them to my machine? I am very anxious about this, and want you to do me the favor to sit right down after reading this & write me all about it—& if the machine you talked into at Chicago, the New Bergman with a Mica diaphram[4] is a good one & talks as well as any you have now on hand? And also give me such information as will help me out of this loosing business, that spoke such words of promise to our ears, and broke them to our hope—[5]

Just to show you what a humbug you are will state, that I was explaining & operating the machine to a couple of French ladies from Cork, and was flattering myself what a splendid showing up I had made with "The Greatest Wonder of the Age" One of them exclaimed "O och! Thats nothing; I saw that in Ireland years ago. A man spoke into a bunghole of a barrel, and the barrel talked back again"

A good many of your Detroit friends were greatly disappointed that you did not come this way. I met a W. S. Sears who is train dispatcher at Adrian, quite an old man,[6] and he said if Tom Edison will come here with that same old straw hat, linen coat and pants that he wore when he reached Adrian from Kentucky[7] I'll guarantee him the biggest reception he ever had, & I said Amen— I wished he would, & at 25¢ a head.

But setting all this aside please write me on receipt of this & give me all the points and encouragement you can. Remember me to Batchelor & all. Truly Your Friend

W F. Wheeler[8]

Address me at this House.[9]

ALS, NjWOE, DF (*TAEM* 18:1048). Letterhead of Antisdel House. [a]"Detroit," and "1878." preprinted. [b]Obscured overwritten letters. [c]"no . . . been" interlined above.

1. The specific clipping has not been found; however, it was almost certainly based upon the 30 August *New York Daily Graphic* article, "The Machine that Speaks," which announced a new, significantly improved phonograph that Edison claimed "talks far better than any other phonograph we have ever had" and that would soon go on exhibit in the Kurtz gallery. The article asserted that "the instruments now on exhibition throughout the country are very imperfect." Cat. 1240, item 860, Batchelor (*TAEM* 94:340).

2. Wheeler had obtained two phonographs (numbers 46 and 77)

from the Edison Speaking Phonograph Co. in late June, after Edison had introduced the extra-large flywheel design (Doc. 1369). His statement suggests that S. Bergmann & Co. may have begun manufacturing phonographs with flywheels about that time. Alternatively, it is possible that this is one of the new $200 machines built by Bergmann in July (see Doc. 1397 n. 1). The June royalty statement indicates that Wheeler paid $100 each for his two machines, but James Redpath claimed in mid-August that he had one of the early $200 machines and noted that "improvements have been made since it was built." Wheeler may have obtained one of the $200 machines sent to George Bliss and his associates in the Chicago phonograph agency in early August in exchange for the old $100 Partrick & Carter phonographs. Edison Speaking Phonograph Co. royalty report for June 1878, DF (*TAEM* 19:183); Redpath to F. W. Jones, 18 July 1878; Redpath to Bliss, 24 July 1878; Redpath to T. Addison, 17 Aug. 1878; all ESP Lbk. 4:109, 126–27, 483–84; Charles Cheever to Bliss, 6 Aug. 1878, ESP Lbk. 1:486, UHP.

3. Besides the article mentioned in note 1, Wheeler may also have seen "Edison" in the 12 July *Chicago Tribune* (p. 3). This was a reprint of "Edison's Anger Excited" from the 9 July *New York World* (p. 1), in which Edison described a recently-completed phonograph (see headnote p. 370 n. 7).

4. This may refer to a phonograph like Doc. 1416. On 23 September, Redpath wrote that Bliss had "one of our $200 machines made about a month ago. By this time he should be able to obtain very satisfactory results. We have made no improvements since selling that instrument,—except in the quality of the tinfoil" (Redpath to J. W. Rich, 23 Sept. 1878, ESP Lbk. 5:229–30, UHP). Edison visited Bliss in Chicago on 21 August and again on the 24th (see Doc. 1404 and "The Gains of Genius," *Chicago Sunday Telegraph*, 25 Aug. 1878, Cat. 1032:88, Scraps. [*TAEM* 27:870]). However, the only known $200 phonograph sent to Bliss was shipped on 6 August (Johnson to Painter, 6 Aug. 1878; S. Bergmann & Co. bill to Edison Speaking Phonograph Co., 3 Aug. 1878, Box 4; both UHP; Speaking Phonograph Co. royalty report for August 1878, DF (*TAEM* 19:190); see also Doc. 1397 n. 1).

5. Later in the year Wheeler was giving exhibitions in Virgina without complaint. Wheeler to TAE, 20 Nov. 1878, DF (*TAEM* 16:463).

6. Nothing more is known of Sears.

7. Edison had worked as a railway telegrapher near Adrian, Michigan, during the winter of 1863–64 and had been an operator in Louisville, Ky., for Western Union during two different periods in 1866 and 1867, but nothing is known of the occasion referred to here. *TAEB* 1:15–18, Apps. 1–2.

8. William Wheeler had been one of the first to hear the newly completed phonograph at Menlo Park early in December 1877 and had obtained from the Edison Speaking Phonograph Co. the franchise for exhibitions in Michigan (Doc. 1143; letterhead of Wheeler to TAE, 3 Aug. 1878, DF [*TAEM* 15:1029]). Wheeler apparently was an associate of George Bliss; he had been an agent for the electric pen in Chicago and in part of Canada, and became general eastern agent for the pen (*TAEB* 3:410 n. 2., Doc. 1037; letterhead of Wheeler to TAE, 2 Mar. 1878, DF [*TAEM* 19:839]).

9. Wheeler had written from the Antisdel House at the corner of Michigan and Washington Avenues in Detroit.

-1420-

To the Editor of the Scientific American

Menlo Park, N.J., Sept. 4, 1878.[a]

To the Editor of the Scientific American:

Referring to the communication from Mr. John Thomson which you kindly sent me, I have every reason to believe that the tasimeter will do all that he proposes.[1] It certainly is infinitely delicate, and its only limit seems to be in dexterity of manipulation. Last evening, while using the Thomson galvanometer, the spot of light went off of the scale when my hand was placed in line with the tasimeter standing at a distance of fifty feet away from the instruments.[2]

T. A. Edison.

PL, *Sci. Am.* 39 (1878): 196. [a]Place and date not those of publication.

1. Possibly the John Thomson who had recently received patents for improvements in watches. He later moved from Rochester to Brooklyn and received patents for water meters and printing presses. *DAB,* s.v. "Thomson, John."

Thomson's 24 August letter to *Scientific American* responded to an editorial in the issue of that date. The editorial, "Edison and the Unseen Universe," described Edison's plans to fit the tasimeter to a telescope to detect stars invisible with even the most powerful optical telescopes. In his letter, published above Edison's reply, Thomson suggested using the tasimeter to measure distances from earth to celestial objects. He thought it would be possible to calculate the distance to the sun if the tasimeter could be used to establish a ratio between changes in the amount of heat recorded and the instrument's distance from the source. He suggested placing one observer below the sun's passage at mid-day, and another several thousand miles to the west. If both measured the heat of the sun's rays at exactly the same time with an "instrument sufficiently sensitive to detect the loss of heat by the passage through the larger space, we can then at once determine the distance of the sun from the earth, and bid farewell to slow coming transits." Thomson estimated that the tasimeter would have to be sensitive to "the loss of heat for every inch of removal of a body distant half a mile from the instrument." *Sci. Am.* (39:112), Cat. 1240, item 830, Batchelor (*TAEM* 94:325).

2. Publicity about Edison's experiments with the tasimeter prompted others to write directly to him. John Long, who was studying at Tübingen and soon afterward became professor of chemistry at Northwestern University, had written Edison on 11 July about scientific applications of the tasimeter. Long wanted to measure the conductivity of heat through fluids and needed "a finer thermometer than any which physicists at present possess" (DF [*TAEM* 19:423]; *DAB,* s.v. "Long, John Harper"). Edison replied on 26 September, "I think I am safe in saying that the Tasimeter will do that which you require the delicacy of the instrument is infinite and depends upon manipulation." He added that he had deflected the beam of a Thomson galvanometer several inches by "the heat of the hand at a distance of 29 feet from the tasimeter at a time when the temperature of the room was very near that of the hand" (MM Coll.).

Another inquiry came from William Curtis Taylor, for whom Henry Bentley had written a letter of introduction in the spring. In a letter of 2 September, Taylor asked whether the tasimeter could detect changes in the intensity of light from the variable star Algol. He further explained his research in a letter of 5 September, and later offered his own "very fine" telescope for Edison's tasimeter experiments. Taylor to TAE, 12 Apr., 2, 5, and 7 Sept. 1878, DF (*TAEM* 15:513, 19:433–37); other inquiries about tasimeter applications are Jonathan Chace to TAE, 7 Sept. 1878, and George Thomas to TAE, 12 Sept. 1878, both DF (*TAEM* 19:438–39).

-1421-

From Edward Johnson

New York Sept 4/78

My Dear Edison

Our Kurtz Gallery enterprize is going to prove a success if I can get some more of your things on the boards speedily.[1] Farther it is going to be the neuclus of Redpaths Tour scheme[2] It will be a practical school or organizing Head Quarters for properly shaping your various inventions for Exhibition In view of this it will be a good thing for you: And again I will agree to pay you 10% of the profits at Kurtz. and will energetically enter the field as not[a] only a clear and practical Exponent of your discoveries and inventions, but will Champion your priority rights and personal character for fair dealing. I am going to give a grand Exhibition for the benefit of the Yellow[a] fever sufferers,[3] and will address a Letter to Mayor Ely[4] as soon as I can get 2 or 3 more of your things in—asking him to appoint a man to take the tickets—and informing him that you join me in this contribution— It will be a big card for both of us. What I want you to do is to help me all in your power to get the thing under way.

1st Loan me a complete Tasimeter Outfit until I can get one made—I have failed to borrow and Bergman cannot make without a model.

2nd. Obtain from the Western Union the privilege of Exhibiting the Carbon Telephone—with a Set of Instruments. They hesitate to grant it to me on a/c of my connection with Bell Tel. Co. You can put that to rest, by a personal application for me as your Agent.[5] You know I'll do it justice.

3rd Supply me with the necessary data for setting forth your priority claims on nights that I shall specially advertize as "Microphone" or "Telephone" nights.[6] Also nudge a newspaperman as opportunity may offer—to notice my progress.

Join me in this and before Oct 1st you will see New York aglow with the Edison Museum. It only requires a[a] slight effort to get the Ball rolling. answer promptly Yours

Johnson

ALS, NjWOE, DF (*TAEM* 16:12). [a]Obscured overwritten letters.

1. According to a newspaper interview with Edison, the exhibition had been scheduled to open on Friday, 30 August. On 31 August, Johnson telegraphed Edison asking permission to display the phonomotor and advertise the device in the Sunday newspapers; Edison wired his consent the same afternoon. Johnson's notice in the 1 September *New York Herald* described only the phonograph exhibition, but the following week he advertised the phonomotor, musical telephone, and other Edison inventions "in preparation." An undated advertising circular for the exhibition promised, for a twenty-five cent admission price, displays, demonstrations, and explanations of Edison's phonograph, microphone, phonomotor, and musical telephone, along with Bell's speaking telephone—treated as an instrument of "great delicacy" used in illustrating other devices. The circular also promised that "other inventions of Prof. Edison are in preparation, and will be early placed on exhibition." "The Machine That Speaks," *New York Daily Graphic,* 30 Aug. 1878, Cat. 1240, item 860, Batchelor (*TAEM* 94:340); DF (*TAEM* 15:1104–5); *New York Herald,* 1 and 8 Sept. 1878, 4, 13; Edward Johnson, "Exhibition of Edison's Inventions," Cat. 1032:128, Scraps. (*TAEM* 27:917); an undated circular advertising the phonograph and phonomotor is in Box 4, UHP.

2. On 2 July, James Redpath had proposed a series of exhibitions of Edison's inventions to begin on 1 October, when the exclusive phonograph exhibition contracts ended. He planned to include the phonograph, the speaking telephone, the phonomotor ("to supply a humorous element"), the megaphone and a hearing aid (as soon as Edison developed the latter), the aerophone, and the musical telephone "or some other curiosity." Redpath proposed two alternative schemes. In one he would get twenty percent of the gross receipts after deducting an amount not to exceed ten percent for "Agents of Theatres or Lyceums for securing engagements." In the other he would receive twenty-five percent of the gross receipts after deducting an amount not to exceed ten percent to "pay for securing engagements." It is unclear whether Redpath's trip to Boston later in the month was connected to this scheme (see Doc. 1452), but nothing seems to have come of it. Redpath memorandum, 2 July 1878, ESP Lbk. 4:2, UHP.

3. Beginning in August, New York dailies often carried reports of the yellow fever epidemic in New Orleans and the lower Mississippi Valley. Edison donated twenty dollars to the Telegrapher's Relief Fund for victims of the epidemic. *J. Teleg.* 11 (1878): 278.

4. Smith Ely, Jr., served three terms as a Democratic representative to the U.S. House of Representatives before being elected New York mayor in 1876. He retired from public life at the end of a single two-year term. *DAB,* s.v. "Ely, Smith."

5. See Doc. 1450.

6. Johnson's advertising circular announced that "Mr. Edison's claim of priority of discovery" of the microphone was "clearly set forth and

sustained" at the exhibition. "Exhibition of Edison's Inventions," Cat. 1032:128, Scraps. (*TAEM* 27:917).

-1422-

Technical Note: Multiple Telegraphy

[Menlo Park,] Sept 4th 1878

Edisons Carbon Resistance Quad Carbon Rheostat[a]

135 Plumbagoed linen[1b] ~~Test 2 on 3 post 1 cell Callaud~~

These tests taken on 1 cell Callaud on 1 post.

135 Discs	Deflec. 9	1340 ohms
135—	Deflec. 40	120 ohms[c] Screw[d] moved down 9/16.
½[e] 67 Discs.	Deflec. 3—	3760 ohms
	Deflec. 46—	60 ohms.
¾[e] 101 Discs	Deflec 3	3760 ohms
	Deflec. 42.	90 ohms
¼[e] 34 Discs	Deflec. 3	3760 ohms.
	Deflec [4]9½[f]	30 ohms.
34 Discs	Same with 3 cells	4~~70~~950 ohms
		37 ohms.

The one cell tests are probably unreliable owing to slight deflection

	deflection	
67 Discs	Deflection 7.	5,600 ohms
	" 69—	67. ohms
101 Disc~~t~~s.[g]	Deflection 67.	107 ohms
"	" 5½	6706.

Want it to test 17 with pressure

Discs used last night No 3 coil 1 cell callaud Deflect 1 ½ with pressure 34[h]

No 1[i] Make solution that will give ½ this and try it

Water 4 oz
Dextrine 1 oz
Plumbago ½ oz.

This[j] test 2 & 46—[h]

Water 4 oz
Dextrine 1 ½ [oz.][f]
Plumbago ½ oz.

This[j] tests 1½—22[h]

Water 4 oz.
Dextrine 1 oz 15dwt[2]
Plumbago ½ oz.

This[g] tests 22— This was rubbed off a little more than the last[h]

Water 4 oz
Dextrine 2 oz.
Plumbago ½ oz.

This tests 18

T A Edison — Chas Batchelor
Martin Force — J Kruesi

X, NjWOE, Lab., NS-78-003 (*TAEM* 7:786). Written by Batchelor; document multiply signed and dated. Unclear calculations in margin not transcribed. [a]"Quad Carbon Rheostat" written by Edison. [b]"Plumbagoed linen" underlined twice. [c]"135 . . . ohms" underlined twice. [d]Preceded by brace spanning previous lines. [e]Followed by brace spanning this and next line. [f]Document damaged; text from copy made by William Carman in Cat. 996:275, Lab. (*TAEM* 3:344). [g]Obscured overwritten letters. [h]Followed by centered horizontal line. [i]Interlined above. [j]Preceding formula spanned by brace.

1. Earlier in the year Edison had devised a quadruplex carbon rheostat using fifty silk disks saturated with plumbago (Doc. 1377). These experiments with linen disks were made with a new rheostat that was square rather than round in cross-section. During the course of the experiments, Edison and Batchelor drew designs for finely adjusting the pressure on the disks and compared how much resistance was added with each change in adjustment of the old and new designs. Experiments with the carbon rheostat continued through September. To assist in the experiments they also designed a device for testing the change in resistance of the carbon disks under a specified weight; this was similar to one they had used in 1877 for testing carbon compositions for telephone transmitters (see *TAEB* 3:469 n. 1). NS-78-003, Lab. (*TAEM* 7:785, 788–97).

2. Pennyweight; 1/20 oz.

-1423-

George Barker to Stockton Griffin

Brookfield Center, Conn. Sept. 5, 1878.

My dear Mr. Griffin:—

On our way East, I agreed with Mr. Edison to arrange for him an exhibit of Mr. Wallace's splendid large magneto-electric machines at Ansonia if he would go up there with me the second Sunday in September. To this he assented. So on my return, I wrote to Mr. Wallace and he has made all the arrangements for us and is expecting us there Saturday night. I wrote to Mr. Edison on Monday last telling him of these arrangements, and asking him if he would meet me there Saturday night.[1] To this letter, I have received no answer yet, though I asked to have one. As I return to Philadelphia next week, this is the only available Sunday. Dr. Chandler[2] of New York wants also to be present and I want to know in season to notify him. Mr. Wallace, I presume, would also like to know positively as soon as may be. I write therefore to you to ask you to put Edison on the right track, and telegraph me on the receipt of this that he will meet us as desired.[3] I know he will have a good time and I want him to see a 7 inch arc and a ¼ inch copper wire 12 ft long heated red hot. I desire too, to have him meet Dr. Chandler. There was a check too in the letter, I sent.[4] So I would like to know for this reason too, whether it was received.

I hope you all recognized how much better Mr. Edison looked after his trip. It did him a heap of good and I think he enjoyed it. I shall be at Menlo before long to see how you all are. Regards to Bachelor. Cordially yours

George F. Barker.

The train for Ansonia leaves the Grand Central Depot, N.Y., at 3 P.M. and has a through car for the Naugatuck R.R. There is a 4.30 train, but then Ansonia passengers have to change at Bridgeport.

ALS, NjWOE, DF (*TAEM* 17:922).

1. On 2 September, Barker had written Edison, "I have arranged the trip to Ansonia that we spoke of, for Sunday next. You to leave the Grand Central Depot at 4.30 P.M. on Saturday with Prof. Chandler. I will meet you in Ansonia & Mr. Wallace will show us all sorts of nice things. Please let me know if this suits you." DF (*TAEM* 16:5).

2. Charles Chandler, professor of chemistry at Columbia University, cofounded the School of Mines there in 1864. *DAB,* s.v. "Chandler, Charles Frederick."

3. On 6 September, Edison telegraphed Barker, "Will meet Chandler at Grand Central Depot tomorrow P.M. Batchelor goes with me. Check all right" (DF [*TAEM* 17:924]). Barker replied the same day, "Telegram just received. Glad Bachelor is going. I am coming to New York tomorrow & will meet you & Chandler at the Grand Central Depot at 3 P.M. train. Shall be at W.U. Tel. about 10." DF (*TAEM* 17:924); this answer was mistakenly dated 9 September in *TAEM-G1*.

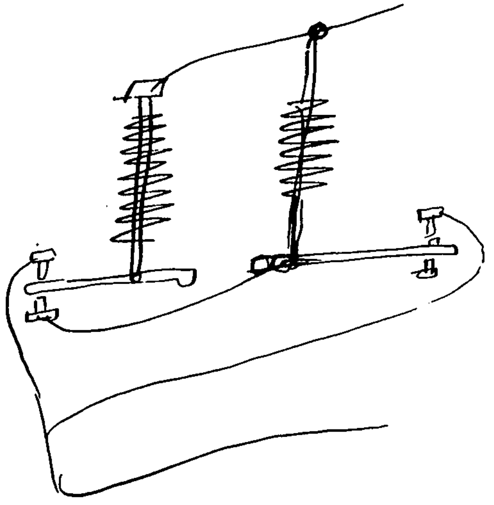
4. In his letter of 2 September (see note 1), Barker thanked Edison for "the Western trip" and enclosed a check for "$100 to balance accounts."

-1424-

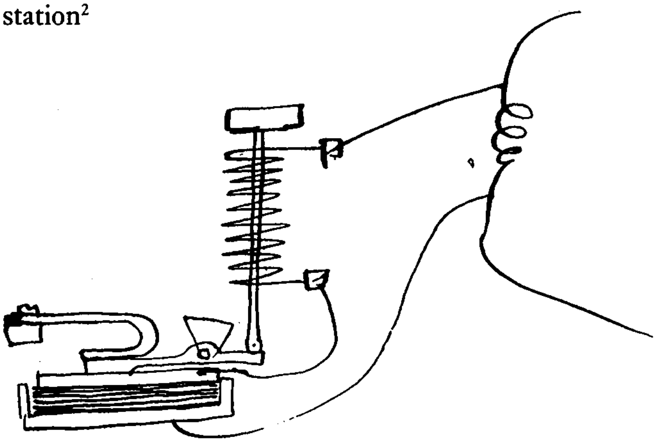
Technical Note: Electric Lighting

[Menlo Park,] Sept 8 1878[1]

Electric Lamp



It may be possible that one regulator at the Central Station may be made to do it for all the main current being regulated by the heat of a large spiral so that as the current strength rises to a point approaching the melting point of all the spirals that it will be opened by the effect of the spiral at the central station[2]



Carbon discs or other finely divided metal.[3]

Thomas .A. Edison

X, NjWOE, Lab., Cat. 1146 (*TAEM* 6:628).

1. These drawings were made the same day as Edison's visit to William Wallace's shop. He also sketched some ideas related to other modes of lighting—electric arc lights (Vol. 16:8, Lab. [*TAEM* 4:487]) and an alternative type of kerosene lamp (NS-78-005, Lab. [*TAEM* 7:808]; see also Doc. 1442)—as well as other electric lamps of this type (see Doc. 1427 n. 1).

2. In this design, as the spirals expanded they caused the lever and contact arrangement to act like a telegraph key opening the circuit.

3. This regulator design, incorporating what Edison called his "tasimeter principle," is similar to those he had drawn on 14 April (Doc. 1289). Cf. Doc. 1427 (fig. 21) and a drawing of 13 Sept. 1878, Cat. 1176, Lab. (*TAEM* 6:631).

-1425-

To Theodore Puskas

[Menlo Park,] Sept 10—1878

My Dear Puskas

Please see enclosed letter from Mr Bliss. From what he writes and from information gained from various sources I have about concluded to set Beetle down as a fraud— I merely send this letter for your own information and I do not wish you to understand that I place any reliability on that part wherein your name is mentioned— Very Truly

T. A. Edison G[riffin]

ENCLOSURE[a]

Chicago Sept 7. 78[1]

Dear Sir—

I send you a Tribune of yesterday and today.[2] Beetle writes quite fully in regard to Paris matters. He says Puskas has rec'd over 20 000 francs for exhibiting the phonograph in Paris. I suppose none of this has been sent over as none has been sent to me. He says Puskas is a high liver and that Bailey now has him under his thumb as he is ~~helping~~ advancing money from time to time to help him along in his family and other expenses

Beetle thinks Puskas has tied up the phonograph and telephone so they cant be sold. Beetle says Herz is backed by the managing director of the Bank of France and controls large amounts of money. Herz is bound to get the Carbon Telephone and recently went to Puskas and Bailey and offered to buy at 50,000 00 gold for Europe Beetle thinks 80 000 00 can be got out of the crowd Herz and his friends get no satisfaction and Beetle thinks the fair thing is not being done by you. If what he says about the capital of the Telephone Cos forming is true there ought to be a handsome thing made out of the situation. I give the information for what it is worth and yet it looks probable Beetle is about to sail for this country and has found a strong party to back him in the pen business. It is not Herz or Roosevelt. He intends to make a cash offer when in NY for the pen patents and will have the funds in hand. That is what we want:

I shall be down in a week or ten days and will bring along the details of letters

Think we had better take it cool and believe shall get a good result shortly

I am glad you are growing fat and that the water Telephone is the cause—

Phono Exhibits run about the same—

If withholding goods will bust me the W.E.M Co are bound to do it but the game wont win. The pen business promises fair if supplies can be obtained. I am going to try and fix it some way so they can be Respy

(signed) Geo H Bliss Gen Mangr

L (letterpress copy), NjWOE, Lbk. 3:361 (*TAEM* 28:800). Written by Stockton Griffin. [a]Enclosure is L (copy), NjWOE, DF (*TAEM* 16:23), copied by Griffin.

1. Stockton Griffin wrote at the top of this letter "Original Recd Sept 10. 78 & sent to Puskas same date."

2. Not found.

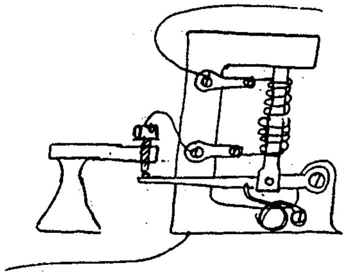
-1426-

Notebook Entry: Electric Lighting

[Menlo Park,] Sept 10 1878

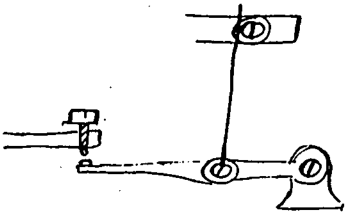
Electric Lighting: Subdivision

Exp. 1



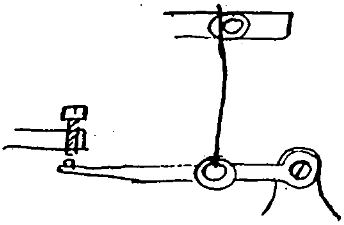
Platina spiral heated to incandescence expands a zinc rod so as to open and control circuit. This works well but gets hot making one larger[1]

2



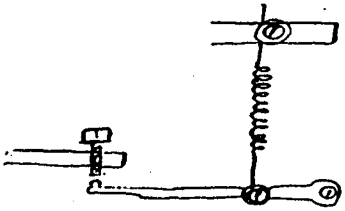
Platina rod heated to incandescence expands and opens its own circuit. This regulates very rapidly

3



Steel rod heated expands and regulates its own circuit

4



Platina spiral expands and opens circuit

5 Steel spiral in ~~P~~place of Platina gives very good light and shall do a great deal of experimenting with it in place of platinum on account of cost[2]

X, NjWOE, Batchelor, Cat. 1317:69 (*TAEM* 90:691). Written by Charles Batchelor.

1. Edison's drawing of a spiral regulator similar to this one is found in Vol. 17:10, Lab. (*TAEM* 4:490).

2. Edison had discussed the high price of platinum and its use in telegraph instruments in an 1875 *Operator* article (Doc. 489). Among the laboratory scrapbooks is one labeled "Platinum Group" that contains material about platinum and related metals (Cat. 1134, Scraps. [*TAEM* 27:678]).

-1427-

Draft Caveat: Electric Lighting

[Menlo Park, September 10, 1878?][1]

Caveat for Electric Light spirals 1

The object of this invention is to produce light for illuminating purposes by metals heated to incandecence by the passage of an electric current through them, a great number of pieces of such metals forming part of an electric circuit and distr~~a~~ibuted at various parts of the same

The invention consists in devices whereby the heat arising from the passage of such current is utilized to regulate the temperature of the incandecent metal which serves to give the light so that it is never allowed to reach its melting point, now matter how strong a current attempts to pass through.

Heretofore strips, spiral wires of Platinum, Iridium and other metals have been included in the electric circuit and the passage of the current through them has brought them to a state of incandecence thus giving light but a careful regulation of the strength of the current is necessary otherwise the wire will either be melted or fall below a temperature necessary to give a good light.[2]

My invention is adapted to overcome this constant watchfulness and cause each spiral to automatically regulate its own temperature. I shall describe many variations in the devices which I am now or which I propose to experiment with—

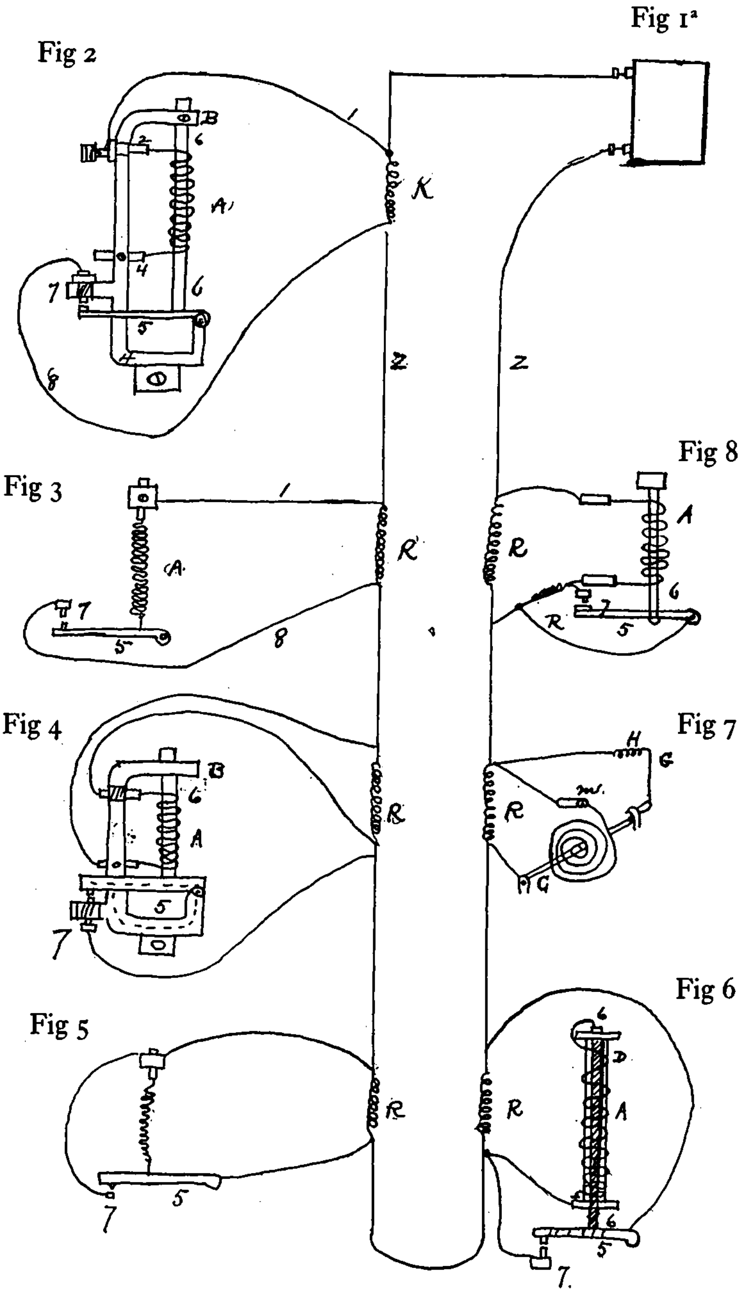


Fig 1[a]
Fig 2
B
2
6
A'
4
6
7
5
8
1
K
Z
Z
Fig 3
1
R'
A
7
5
8
Fig 8
A
6
R
R
7
5
Fig 4
B
6
A
R
5
7
Fig 7
H
G
m
R
G
Fig 5
R
7
5
Fig 6
6
D
A
R
6
5
7.

Fig 1 is a magneto electric machine supplying currents to a circuit Z-Z.[3]

R.R.R. etc are resistances placed in the circuit at any point where a light is desired. their resistances allows of a portion of the current being shunted through a metalic spiral wire sheet or other conductor which is to be made incandecent;

In figure 2. is shown one form of electric lamp A is a platinum or iridium wire (it may be made of[b] any metal or conductor having a high melting point or be made in a form of a sheet or volute spiral) 6 is a rod preferably of Zinc or other expansible material and this is secured firmly at B and passes through the centre of the spiral A. It connects at the other extremity with a lever 5 and serves to give a downward motion to the same when the rod 6 is expanded by the heat of the spiral on the end of the lever 5 is a platina point which in its normal position rests against the platina pointed screw 7— 4 is the frame of the instrument and is of metal, the current passes through wire 1 to the rod (insulated) 2 thence down the spiral to the rod 5 and frame 4 thence to the screw 7 to wire 8 back to the resistance R. The resistance of the latter is such that it allows of a powerful current to pass within this derived circuit heating the spiral A to incandecence as the spiral approaches its melting point the rod 6 expands and carries the rod 5 away from the screw 7 and opens the circuit. the temperature of the spiral immediately falls as well as that of the rod .6. when these contract and causes the lever to again come in contact with the screw 7. and the spiral again approaches its melting point. the lever 5 which is springy or rather elastic is so adjusted in relation to the screw 7. that within 200 degrees of temperature of the melting point of the metal of the spiral .A. the lever leaves the screw, hence no matter what amount of current is used the heat of the spiral acts upon devices to regulate its temperature and preservation hence an excess of current sufficient to fuse the spiral unprovided with the regulator may be used successfully.

In fig. 3. is shown another modification in this case the connections and operation is the same except that the expansion of the spiral[b] itself is used to give motion of the lever 5.

I[n] fig 4. The circuit is arranged in such a manner that when the lever 5 is thrown downward by the expansion of the rod .6. It comes in contact with the point 7. and forms a second derived circuit[b] thus weakening the current in the derivation containing the spiral and reducing its[b] temperature

In figure 5 the operation is the same except the expansion of the spiral[b] itself gives motion to the lever 5.

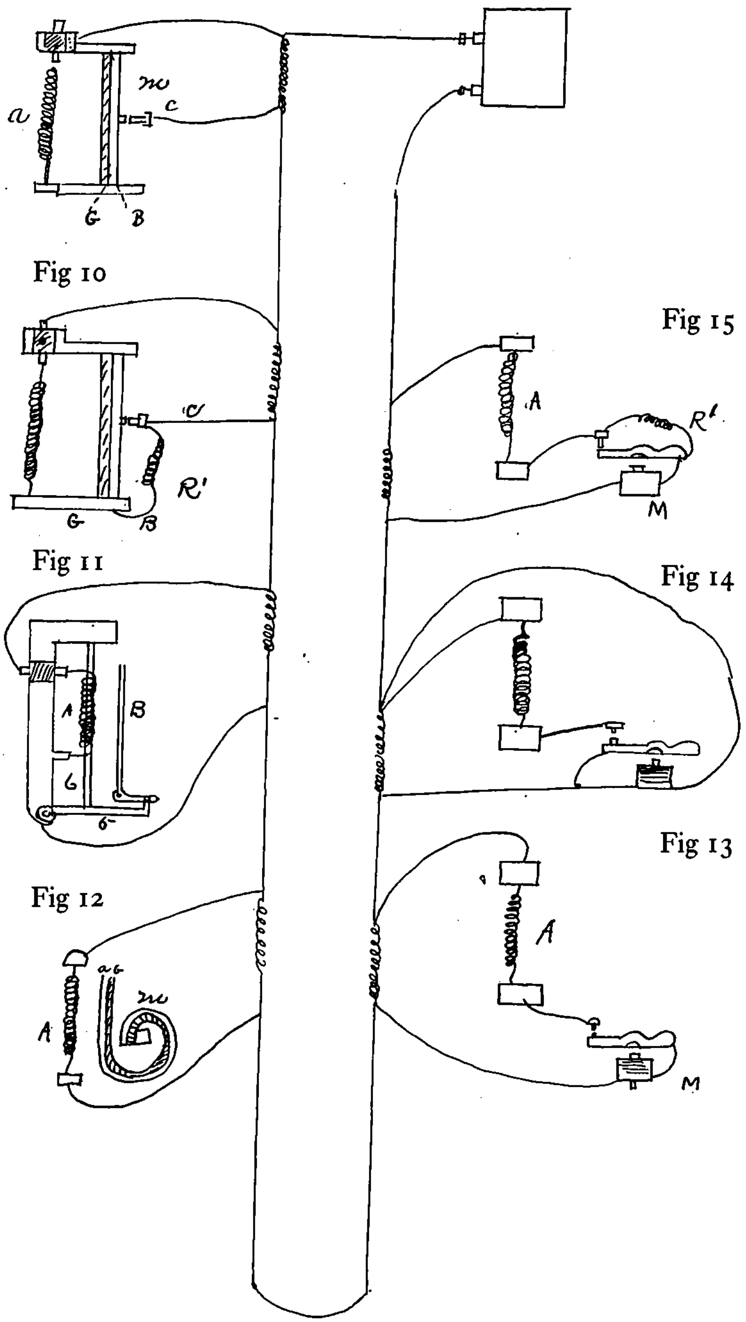


Fig 9

Fig 10

Fig 11

Fig 12

Fig 15

Fig 14

Fig 13

a
m
c
G
B
c
R'
G
B
A
B
G
G
A
ab
m
A
R'
M
A
M

In figure 6. a glass tube d passes through the centre of the spiral—A. through this tube passes the expanding rod 6. The operation is the same as in figure 4 but it is a more convinient device.

In fig 7 is shown the wire to be rendered incandescent coiled in the form of a volute spiral the inner end secured to a shaft C the other end to a permanent fixture m. the shaft has a lever I which approaches or receedes from a platina pointed screw H. when the temperature rises or falls. Its[b] operation is the same as fig 5.

In figure 8 The expansion of the rod 6 and downward movement of the lever 5 places in the derivation containing the heated spiral A. an extra resistance[4] R′ which lowers its temperature by weakening the current—

In[b] fig 9. A is the spiral. M two strips of metal fastened together g being steel and B Zinc (any two substances one of which expands more than the other may be used) These are placed in close proximity to the spiral. in their normal condition B is in contact with the screw C. and the spiral a is heated when it approaches its melting point the strips bow out and connection is broken between B and C the spiral cools and B comes again in contact with C and so on—

In figure 10 the operation is the same except that the circuit is not entirely broken a resistance R′ being included in the circuit when[b] B seperates from C.

In figure 11 the expanding rod 6. gives motion through a compound lever to a cooling bar B. which approaches and cools the spiral as the rod 6 expands.

In figure 12 a double strip .M. secured[5] at X expands and approaches and cools the spiral A as ~~fast~~ its temperature rises.

In figure 13 an electro magnet .M. adjusted to respond to a current of little less strength than would melt the spiral is included[b] in the shunt with it. hence when the current is increased from any cause to melt the spiral the circuit opens.

In fig 14. shows the same thing except the magnet is included in a permanent derivation

In figure 15. the magnet M instead of entirely opening the circuit throws a resistance R′ into the circuit to weaken it

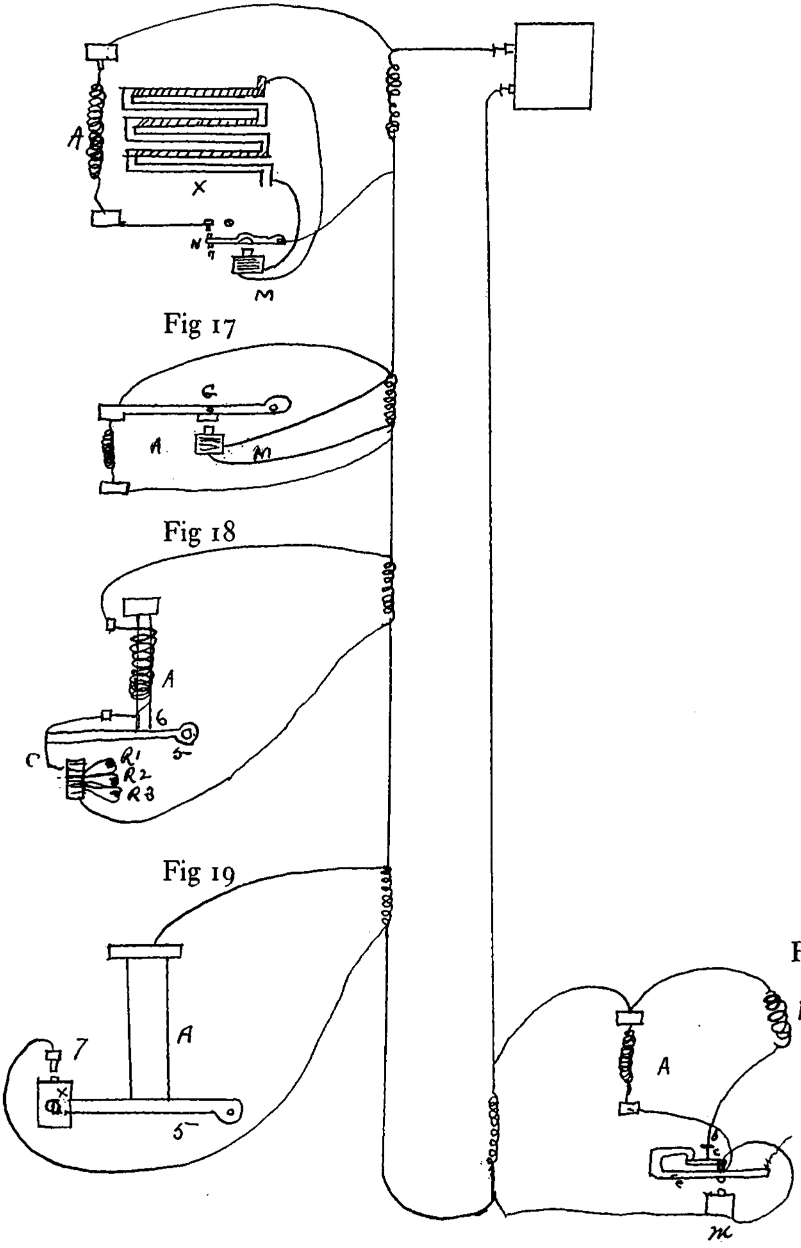


Fig 16

Fig 17

Fig 18

Fig 19

Fig 20

In figure 16 a thermoelectric pile X is placed in close proximity to the heated spiral the current from it actuates a magnet M whose lever N and point O opens and closes the shunt containing the spiral A, when the temperature of the spiral becomes too high the current generated by the thermopile causes the magnet M to attract its lever and open the deriva-

]

tion of the spiral A. its temperature lowers the thermo current weakens and the lever N comes[b] in contact with O and so on—

In fig 17. the lever G of the magnet closes up the spiral when the current increases.

Fig[b] 18 shows the expansion rod 6 throwing in resistances $R^1 R^2 R^3$ on its downward motion. thus weakening the current.

In figure 19. a sheet of platina or other substance is used for giving light by the passage of the current. hung to the bottom is the lever 5 carrying a large weight X on its extreme end.[6] In its normal position the point on X is in contact with 7. but when A becomes too hot its expansion is sufficient to seperate X from 7 and it immediately cools only to make contact and break the circuit again—

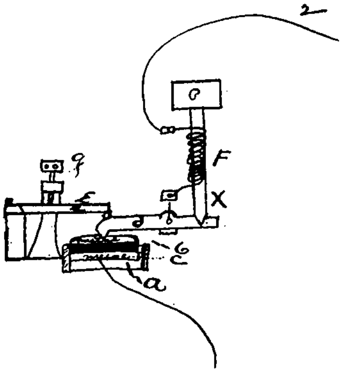
In fig 20 a magnet M. similar to an ordinary Duplex transmitting sounder is included in the derivation when the lever is unattracted the spiral A is[b] in circuit through the lever e and spring C. when the current is increased from any cause the magnet lever is attracted throwing A out of circuit and bringing in a resistence R′ (equal to A) in circuit. this device is not strictly a regulator but is only useful for experimenting where it is deserable to have some device[b] to prevent destruction of the spiral

ADDENDUM[c]

[Menlo Park,] September 13 1878

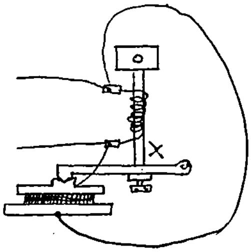
Extension of Caveat for Electric Light Spirals

Fig 21



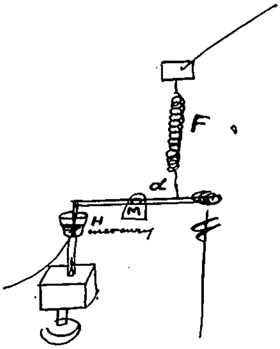
In figure 21. C is a button of finely divided conducting matter that varies its resistance by pressure. This button is placed between two metallic armatures[7] A & B. D is a lever which is pressed down upon the armature B by the spring E aided by the screw .g. X is a rod of material quite expansible by heat this is secured permanently at the top and rests upon the lever D at the bottom. F is the platina spiral. The current passes from wires[8] 1 to the armature .a. through the button to[9] 6 thence through the lever d to the spiral F out again. when the spiral is heated by the passage of the current the rod X expands and decreases the pressure of the lever d^b on the button. resistance is put in circuit by this lessened pressure and the temperature of the spiral decreased. hence by adjusting the rod X and spring e the spiral may be brought to any required temperature.

Fig 22



In figure 22 The arrangement is somewhat different. the expansion of the rod X by the heat of the spiral increases the pressure and decreases the resistance of the button hence cuts off more current from the spiral, thus reducing its temperature.

Fig 23



In figure 23 is shown a spiral F which when it expands throws up the lever, d & breaks contact in the mercury cup .H.

The device may be arranged to short circuit the spiral F when the lever touches the mercury the spiral being placed in the other side of the fulcrum m.

Fig 24

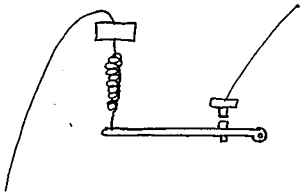


Fig 24 shews the expansion of the spiral opening its own circuit and the contact point being placed near the fulcrum to gain power.

Fig 25

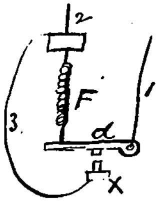


Fig 25 shows it arranged to short circuit the spiral when the temperature is to high the point X may be provided with a spring so that the spiral will not be affected when pressing the lever downward as it would if a rigid point were used.

Fig 26

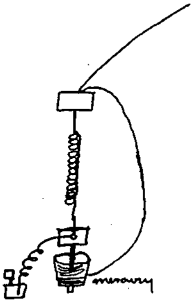


Fig 26 shews a spiral with slight weight short circuiting itself in a cup of mercury or on a spring.

Fig 27

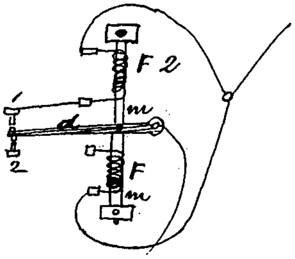
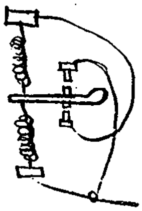


Fig 27 shews a double spiral[10] F1 & F2 with lever d connected to the expanding rods m and m^1 arranged with contact points 1 and 2 so that[b] when f^2 is incandescent m will be expanded and the lever d will leave 1^b and pass the current to F which in its turn will become incandescent and pass it back to f^2

Fig 28



In fig 28. This same principle is shewn with short-circuiting connections

Fig 29.

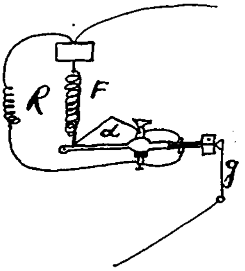


Fig 29 shews a spiral making[b] a lever having two contact[11] 1 and 2 on its extremity insulated from each other. a spring .g is either in contact with one or the other as the spiral is expanded or contracted thus opening or closing the circuit through the spiral or through a resistance R equal to it but of large wire to prevent heating.

Fig 30

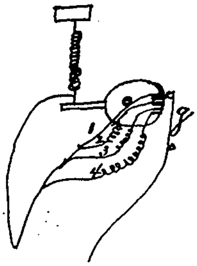


Fig 30 shews a similar arrangement except that as the spirals tends to elongate more and more it is checked by throwing in constantly increasing resistances 1. 2. 3. & 4

Fig 31[b]

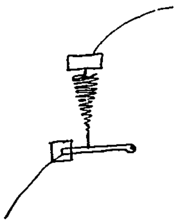


Fig 31 shews a spiral which when not heated has a portion of its spiral touching each other and thus out of action upon the passage of the current more and more spirals and consequently resistance is thrown in circuit by the expansion of the same

Fig 32

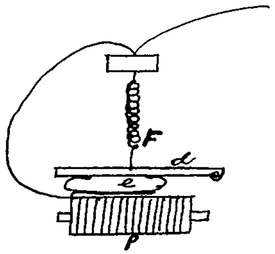
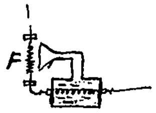


Fig 32 shows a method of gradually increasing the power of the shunt on short circuit. P is a cylinder wound with wire offering considerable resistance. E is a spring which when just touching P comes in contact with but few spirals and as the temperature of the spiral increases the spring e flattens and comes in contact with more convolutions hence shunting more and more current from F

Fig 33



In figure 33 a draft of air. gas or steam set up by the immersed spiral (plate may be used in the water to produce gas by decomposition) in the liquid. augmentation in the current[b] increases the gas and cools the spiral F.

Fig 34

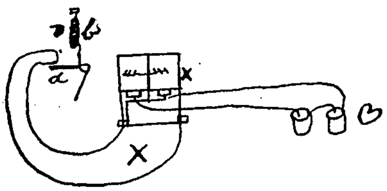


Fig 34 shows an electric or other engine with a fan to produce a draft of air to cool the spirals the draft being regulated by the lever d closing the draft tube .X.

35

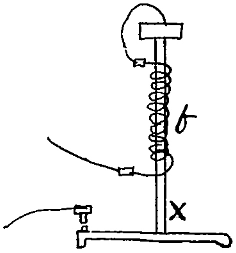


Fig 35 shews the passage of the current through both the spirals F and expanding lever X thus working it by both direct and radiant heat. the short circuiting device may be used in this arrangement.

Fig 36[12]

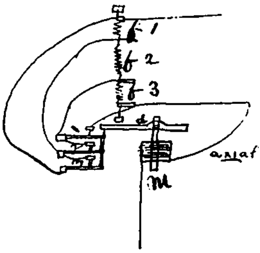


Fig 36 shows (3) Three spirals in the same circuit with the spirals is an axial magnet—M with a lever d working springs 1. 2 and 3. when no current passes the springs 1. 2. & 3 short circuit the spirals Fl F2 F3 when current is closed the magnet causes the lever 1 to cut in circuit spiral F3 if the current strengthens the power of the magnet is increased and causes spring 2 to leave it contact point and cut in spiral F2 and so on. the resistance of the spirals be sufficient to reduce the strength of the current. one spiral might be used and several resistances connected to the springs 1. 2. & 3

37

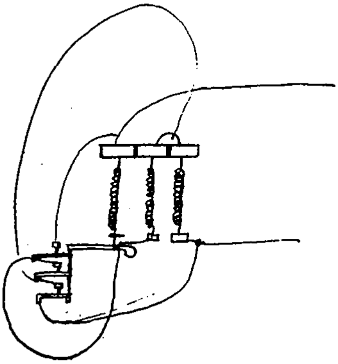


Fig 37 shows a similar principle: the power of the expansion of the spiral being used

38

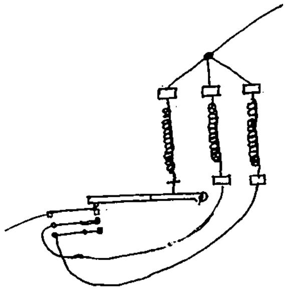


Fig 38 is similar in principle.

Fig 39

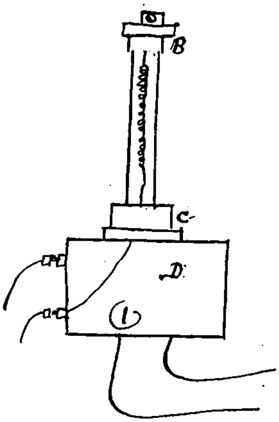


Fig 39 shows a spiral F placed in a glass tube to prevent radiation and allowing the spiral to become incandescent with less current than it would if placed in the open air C & B are caps preferably of some non[b] conductor of heat.

Fig 40[13]

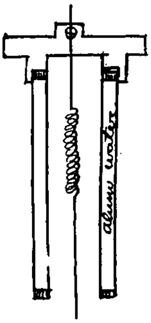


Fig 40 shows double tubes the spaces between being filled with a solution of Alum in water to further decrease conduction and radiation of heat.

Fig 41

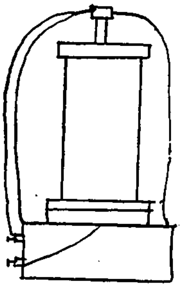


Fig 41 shews a sheet of metalic foil instead of spiral.

Fig 42

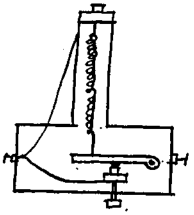


Fig 42 shews a spiral with self regulator inclosed in a glass tube.

Fig 43

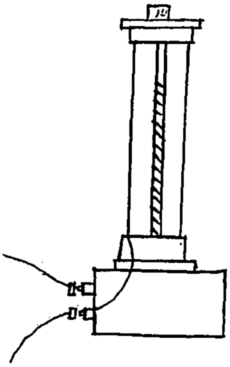


Fig 43 shows a spiral wound around a pencil of lime or similar substance to accumulate heat and thus render the spiral incandescent with much less strength of current—

Fig 44

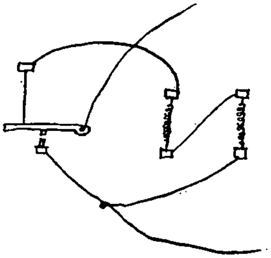
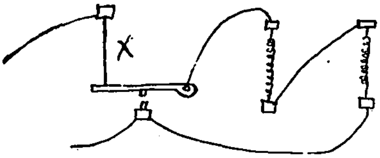


Fig 45[14]



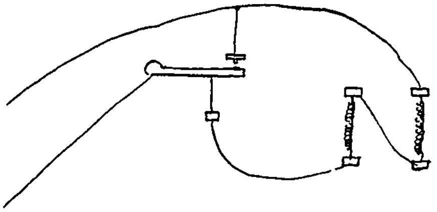


Fig 44 & 45 shews several spirals regulated by a general regulator; for instance if there are 100 spirals in a building they may be arranged with three[b] or four regulators instead of making each spiral ~~to~~a regulator— a straight wire is used as at .X—which is not liable to change like the spiral. The regulation takes place at much lower temperature than on the spirals— I will mention that these spirals may derive the current from the main wire by being placed in derived circuits, or placed directly in the circuit or the ends of all connected to one pole and all the other ends to the other pole;[15]

I will also mention that any source of electric power, such as a battery or magneto machine of the usual construction may be used, but I am now engaged in experimenting on an improved magneto Electric machine. I use a large tuning fork each prong being provided with a steam cylinder and valve which serves to keep the prongs in continuous vibration by steam power and providing the prongs with electro magnets faceing other Electro magnets and with suitable contact points obtain powerful induced current by the rapid approach and recessetion of the magnets[16]

I shall probably claim

1st Regulating the temperature of conductors heated by the passage of an Electric current by their own expansion or the expansion of adjacent bodies by the radiant energy of the heated body substantially as set forth

2d The method of reducing the temperature of a body heated by Electricity by causing its expansion to shunt the electricity from it and reduce the amount

3d A magneto Electric machine composed of a tuning fork or reed kept in continuous vibration by steam power as set forth and magnets and their commutators for the purpose set forth.

4th I claim the various devices herein described to carry out my invention in a practical manner for its various uses.

Df (copy), NjWOE, Lab., Cat. 997:49 (*TAEM* 3:376). Written by William Carman. [a]Drawings are on six separate pages. [b]Obscured overwritten letters. [c]Addendum is a Df (copy), written by William Carman.

1. The first part of this caveat was probably drafted on 10 September, the same day that its first lamp design appears in the experimental record (Doc. 1426). Edison had apparently begun thinking about the designs on 8 September, the same day he visited William Wallace's shop, when he made at least 12 drawings that were probably intended for a caveat. Only four of these survive; numbered 9–12, they are figures 14, 15, 16, and 18 of the caveat (NS-78-005, Lab. [*TAEM* 7:813]). No original text survives. The text and drawings for the first 20 figures were certainly done before 13 September, when Edison made the drawings (and presumably wrote the text) for figures 21–40 as an "Extension of Caveat for Electric Light spirals."

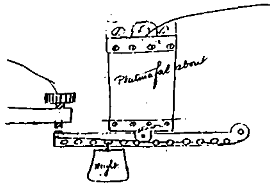
2. A table summarizing prior electric light research is given in Friedel and Israel 1986, 115. It is derived from Bright 1972, 35–54.

3. Edison had very limited experience with electric generators prior to this time. He first saw a Gramme dynamo in England in 1873 (Doc. 346) and no doubt saw J. B. Fuller's magnetoelectric generator between 1875 and 1877 when it was used in experiments on telegraph circuits in New York City (Doc. 634). However, there is no evidence that Edison himself had experimented with these or any other generators prior to the drafting of this caveat. Drawings of his 1877 experiments, like this caveat, show a box labeled "magneto machine" to represent a generator, but his actual power source was a bichromate battery (see *TAEB* 3:540; Doc. 1044).

4. At lower left, labeled "R."

5. "X" is not shown.

6. On 14 September, Edison drew an alternative design for a foil burner in which the position of the weight on the lever could be adjusted. Charles Batchelor then gave John Kruesi instructions to make lamps of this design with one and two contact points. Vol. 16:18–19, Lab. (*TAEM* 4:498–99).



Charles Batchelor instructed John Kruesi to make this lamp and another with weighted platinum foil burners.

7. The label on armature B looks like a "6"; it is probably a misread "b". Text on the two armatures is "metal" and "metal."

8. The bottom wire is 1, but it is unlabeled.

9. "6" is armature B (see note 7).

10. Spirals are labeled "F" and "F2."

11. The labels for contact points 1 and 2 are missing from the drawing.

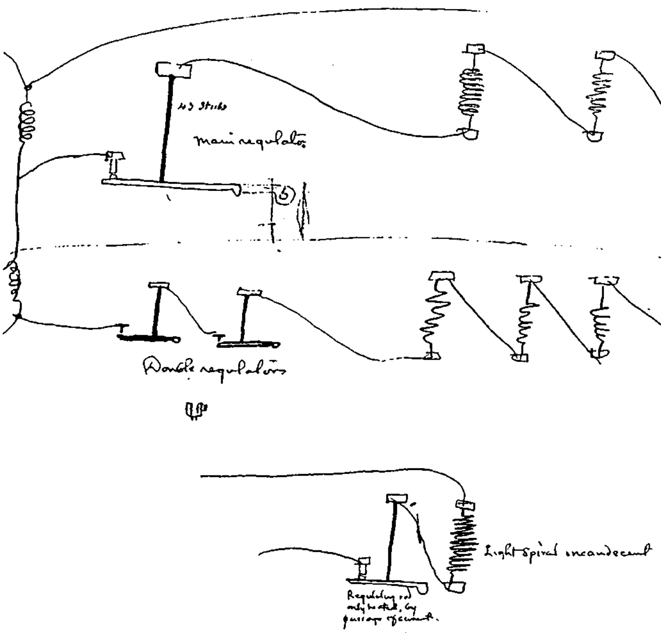
12. Text is "axial."

13. Text is "alum water."

14. The unnumbered drawing included here appears on the first page of drawings for Edison's second draft caveat (Doc. 1456), which follows the drawings for this caveat in Cat. 997. This drawing is directly related to the design of figures 44 and 45 and is unrelated to the designs of the second caveat.

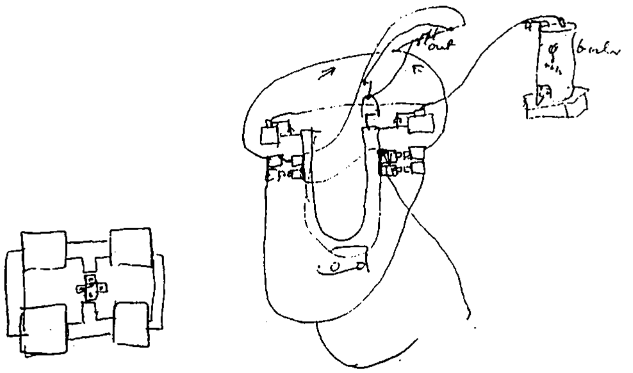
15. On 14 September, Edison drew the design shown here, using what appears to be No. 43 Stubbs steel as the straight wire. He also showed another arangement with two such regulators as well as one with the "regulating rod only heated by passage of current." Vol. 16:17, Lab. (*TAEM* 4:497).

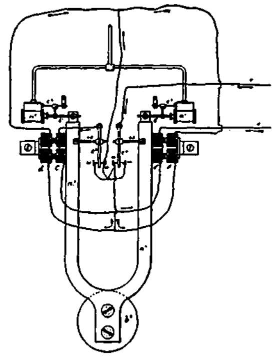
Edison drawings of electric light regulator designs.



16. The following day Edison sketched some ideas about generators, including a tuning-fork generator (Vol. 16:16, Lab. [*TAEM* 4:496]). The tuning-fork design, labeled "Magneto machine with fork," modified his tuning-fork motor to create a direct-current generator (see Docs. 782, 800, and 802). Steam from the boiler (right) drives two double-acting pistons, located on opposite sides of the tuning fork near the top of each prong, vibrating the fork. As the electromagnets attached to the prongs of the fork moved to and from their matched pair of electromagnets, they induced currents in the stationary coils. In this way, Edison hoped to take advantage of his idea that a tuning fork might prove to be an efficient translator of energy. Since the current from this generator would be of alternating polarities, he used a commutator consisting of a single interrupter, shown directly above the right prong of the fork, to prevent one of the polarities from being sent out over the line, producing an intermittent unidirectional current. By passing the current through the electromagnets on the fork he created a dynamo (positive feedback) effect. Edison refined this design into the tuning-fork generator shown in his U.S. Patent 218,166 by 25 October (Vol.

Two of Edison's early sketches of dynamos; one shows a steam-driven tuning fork.





Edison's patent drawing for a tuning fork dynamo (U.S. Pat. 218,166)

14:158, Lab. [*TAEM* 4:609]), although he didn't execute the application until 3 December. In the patent he showed that two interrupters could be used as a commutator to change the "alternate current . . . into one of continuity in the same direction." He also noted that the fork "may be two meters long (more or less) and heavy in proportion."

Another of the 14 September drawings represents a general layout found in many dynamo designs, particularly those of Gramme (see, e.g., King 1962c, 380–87 [figs. 63–71]). The four squares in the drawing represent coils of wire for the field magnet and the sections between them a continuous iron or steel core; the extensions toward the middle would be the poles of the resulting electromagnet. The central cross shape (marked "N," "S," "S," "N," clockwise from the top) indicates where an armature would rotate. As with the tuning-fork design, machines of this configuration could be either generators or electric motors, depending on the nature of their armatures and the various electrical and mechanical connections.

-1428-

To William Barrett

[Menlo Park,] Sept 11th [187]8

Dear Sir

Your favor of the 26th ult[1] was duly rec'd, also a copy of "good words" for which please accept thanks— I noticed the article in Nature to which you refer— I send this day to Col. Geo E Gouraud No 6 Lombard St London a Micro Tasimeter together with a shunting arrangement and a box containing a dozen Carbon buttons.[2] Will you kindly show the Tasimeter to John Browning 63 Strand and if possible leave it with him long enough for him to make measurements take drawings &c so that he will be able to manufacture them—[3] Also please give him six of the Carbon buttons— These buttons are exceedingly delicate and fragile, and will not bear touching with the fingers— It is best not to take the Tasimeter apart until you are through lecturing.

I send herewith directions for using this instrument with a rough diagram which I hope will be understood by you.[4] Very Truly

T. A. Edison per G[riffin]

ALS (letterpress copy), NjWOE, Lbk. 3:366 (*TAEM* 28:805). Written by Stockton Griffin.

1. Doc. 1410.
2. See TAE to Gouraud, 11 Sept. 1878, Lbk. 3:365 (*TAEM* 28:804).
3. See Doc. 1444. The same day Edison wrote Browning that he had shipped the tasimeter and carbons via Barrett. Lbk. 3:366 (*TAEM* 28:806).
4. A draft of these instructions is found in DF (*TAEM* 19:445). Edison described how to calibrate the tasimeter and use it with a Thomson

galvanometer and also repeated the caution that it "is best not to take the Tasimeter apart until you have got through with your lectures & explained it to Mr Browning." Another set of tasimeter instructions was written by Charles Batchelor and includes a wiring diagram (DF [*TAEM* 19:447]).

-1429-

Draft to George Gouraud

Menlo Park, N.J., [September 11,][1a] 1878[b]

Gouraud

You better arrange with Puskas or with the manufacturers in Paris who Puskas contracts with to get your telephone,[2] as we do not fully understand the conditions over there either in wires or in peculiarities of the people.[3]

I have sent Adams a press for moulding Carbons,[4] so you can take adantage of the facilities which Puskas will have I send Puskas today another style of telephone made by the WU Telegraph—Co. who have about 1000, in[c] use here, Chicago San Fran etc=[5] The central system is growing very rapid in NYork about 15 lines per day[6] have written to San Fran—Chicago & NYork for all printed matter relating to this subject for your information=[7] Did you see Brewers report on my 1st[d] telephone patent it is better than I expected=[8]

The magneto telephone is rapidly going out of use here ~~the~~ The W.U. Co are calling them all in & using them merely as receivers= I dont believe Bell can touch us in England on the receiver and I am sure nobody can on the transmitter which is the important part. If you can arrange a Co there I should like to have some money on account as I have gone[c] into the Electric Light & am spending lots of money= When you get everything arranged to sell patents, I will place all the papers in Brewer & Janseens[9] hands with[c] ~~yo~~a contract giving you ½ of the whole thing, but of course the trade must be satisfactory to me and you know I am not unreasonable.

Say to Nottage that we had the Dictating clock plate phonograph working nicely today for first time, and that it will not be long before we shall have it perfect[10] Its going to be a big success.

Your tests[11] seem to prove that Preece didnt give Adams any show on the P.O. Telegraph~~ie~~ & that his statement that my telephones were a failure was a lie.[12] He made a lying statement about Quadruplex before the British Association at Dublin.[13]

I am preparing a phamphlet that will make him very sick I propose to send it to every scientific man in Europe & England, unless he comes out squarely within the next 2 months & explains exactly what I did & what Hughes did & defend me as he should have done at first.

ADf, NjWOE, DF (*TAEM* 16:37). Letterhead of T. A. Edison. [a]Date added later in an unknown hand. [b]"Menlo Park, N.J.," and "187" preprinted. [c]Obscured overwritten letters. [d]Interlined above.

1. "Sept 11" was written at a later date, possibly by an archivist. It is unclear whether a finished version of this letter was ever prepared and sent as Edison's letterbook contains a much shorter letter to Gouraud of 10 September, which, like this draft, is a response to Gouraud's letter of 29 August and cable of 10 September (DF [*TAEM* 19:903, 913]). Edison's 10 September letter answers Gouraud's questions concerning the cost of a telephone set and the number of Edison transmitters in use in the United States (Lbk. 3:362 [*TAEM* 28:801]). This draft addresses other issues as well and was clearly written before Gouraud's cable of 13 September (Doc. 1434).

2. Not identified. It is not clear whether Puskas had yet made arrangements regarding telephone equipment; he apparently had been ready to settle something two months earlier but Edison asked him to wait for a new telephone model. Puskas to TAE and TAE to Puskas, both 8 July 1878, DF (*TAEM* 19:867).

3. Telephones were generally tested on telegraph lines, which in London and other British cities were to a great extent underground. This created significantly different electrical conditions than those found on typical lines in the United States.

4. It had been sent to Adams in Paris (see Doc. 1396).

5. In his 29 August letter (see note 1) Gouraud had asked how many of Edison's telephones were actually in use in the United States. Precisely what Edison based his response on is not known. However, by early August, Western Electric Manufacturing Co. in Chicago had manufactured some 350 Edison transmitters and during the intervening weeks Edison provided carbon buttons for these telephones. He also sent 150 carbon buttons to the Western Union factory in New York, which was making transmitters. Additionally, by 10 October the Gold and Stock Telegraph Co. of California listed over 250 telephones in service in San Francisco alone. In his 10 September letter (see note 1) Edison noted that Western Union had begun filling orders for his telephones about six weeks earlier and "thus far are unable to supply the demand." Enos Barton to TAE, 8 Aug. 1878; TAE to George Scott and TAE to Western Electric, both c. Aug. 1878; TAE to George Walker, 14 Sept. 1878; Gold and Stock Telegraph Co. of California, "Subscription List"; all DF (*TAEM* 19:740, 748, 760, 784).

6. On 5 September the Gold and Stock Executive Committee voted that "the number of lines for the Merchants Exchange circuit to be built on trial in New York may be extended to 100 in all" (G&S Executive, 202; see also Doc. 1332 n. 4). A central system such as this had telephones wired to a common exchange with interconnecting switching equipment, as distinct from point-to-point installations such as dedicated private lines. The first commercial telephone exchange had opened for service on 28 January 1878 (see *TAEB* 3:679 n. 6; Kingsbury 1915, 96).

7. In his 29 August letter (see note 1) Gouraud had also asked for all available information on telephone exchanges. In October, Edison received some of the information he had requested from San Francisco (George Ladd to TAE, 23 Oct. 1878, with enclosures of Gold and Stock Telegraph Co. of California, "Subscription List" and "Telephone Line Contract. Central System," all DF [*TAEM* 19:783–89]). Though little specific information has been found on the growth of the exchanges in New York City and Chicago, see President George Walker's report in American Speaking Telephone Minutes (pp. 33–40; see also Kingsbury 1915, 92–97). These Western Union–controlled systems were operated under the auspices of the American Speaking Telephone Co. and used the facilities and wires of local American District Telegraph companies. On 10 December, Gouraud wrote that he had received a "few printed papers" concerning American telephone exchanges and asked Edison to provide "information as to the number of Towns in the United States in which the Telephone Exchange system has been inaugurated and a few examples of its rapid growth giving statistics" (DF [*TAEM* 19:990]).

8. See Doc. 1392 n. 4.

9. That is, Jensen.

10. For work done on the dictating phonograph during the summer see sketches of 29 and 31 August, Vol. 17:142–43, Lab., (*TAEM* 4:1005–6) and account entries in Cat. 1185:211, 213 and Cat. 1217:193, 199–201, both Accts. (*TAEM* 22:651–52, 752, 755–56).

11. Adams had been planning for at least a month to try Edison's telephones on the London-Paris route once the instruments were installed in England and connections could be arranged for lines across the English Channel. Arrangements were made for a test on 8 September, though it is unclear if the test took place on this day. On 10 September, Gouraud cabled Edison: "Dover & Calais tests great success & from London to Dover perfect Dover to London not so good tube instruments not good on bad wire. Brussels to Dover first class. Dover to Brussels nothing." In his cable of the following day Edison noted that "tube instruments" were suitable "only for short wires." Doc. 1399 n. 5; Gouraud to TAE, 29 Aug., 4 and 10 Sept. 1878, TAE to Gouraud, 11 Sept. 1878, all DF (*TAEM* 19:903, 911, 913; 16:35); J. E. Kingsbury to George Gouraud, 7 Sept. 1878, transcript in Kingsbury 1916, 812–13; Lbk. 3:364 (*TAEM* 28:803).

12. It is not known when Preece made such a statement, but see Docs. 1319, 1365, and 1399.

13. Preece read a paper on "Recent Improvements in Telegraphic Apparatus" to the British Association for the Advancement of Science. The Association's *Report* of the Dublin meeting did not include an abstract, but the paper was published in the October issues of the *Journal of the Telegraph.* Edison probably objected to Preece's statement regarding the history of combining duplex and diplex telegraphy to produce a quaduplex:

> This combination was suggested by Bosscha and Stark, in 1855, and by Mr. Oliver Heaviside, in 1873. It was patented in this country by Mr. Stearns, in 1874. It was devised by Mr. Walby, a Post Office official in Dublin, also in 1873. It was, however, for the first time put into practical operation by Messrs. Edison and Gerrit

Smith, in 1876, upon the lines of the Western Union Telegraph Company, in America, where it is now applied to sixty circuits. It is now being introduced by the Post Office.

Nature, 18 (1878): 484; *BAAS Report* 1879, 697; *J. Teleg.* 11 (1878): 289–90, 305–7, 309.

-1430-

From George Bliss

Chicago Sep't 11th 1878.[a]

Dear Sir:

West & Bond say they sent the bill against Griest to you several days ago to be sworn to and that it has not yet come to hand.[1]

I dont think you appreciate this situation or you would hurry up the matter.

Here is this fiend Griest on the ground floor in the Exposition opposite the main entrance with his machine offerring it at $12.50 wholesale and all I can do is to blow wind at him at which he laughs.[2]

His Co. has a nominal capital of 50.000.00 of which 800.00 is cash, 8.000.00 notes, 12.000.00 machinery and the balance patents.

I was in his shop yesterday and and he has not 1.500.00 worth of tools all told.

If such a party as this is going to run away with a valuable patent like yours you are a different individual from what I believe.

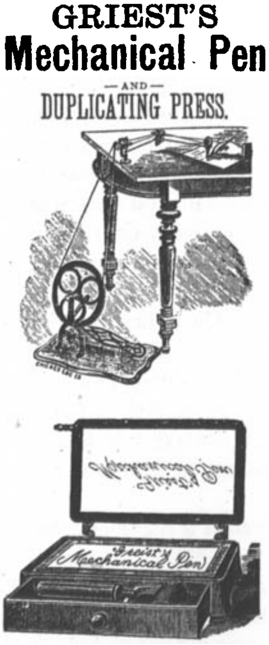
Louderback writes that the Imlay pen people at Phila are pushing ahead and also that there is now a dentist malet pen in the field.[3]

This pretty good evidence that there is value to the pen business and I dont believe the time and money spent on it is going to be thrown away.

If it had been planned a better case than Griest's could not have been arranged to fight for I am certain you will win and one decision reached it can be made lively for the infringers.

Please don't delay in this matter but give me a tangible ground to stand on before the commercial public.

If parties understand that every one who makes, deals in or uses infringements on the electric pen have got to settle there will be comparatively few who will care to pick up the fight against your patent and many more who will not be mean enough to try to rob an inventor who has the reputation you have and who has done as much service to American achievement as yourself.



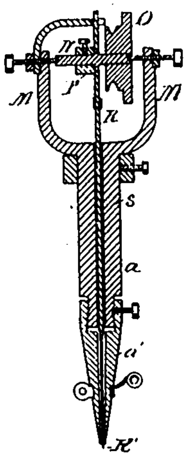
From an advertisement for John Griest's pen and press.

When this thing is fairly under way I am coming down to see our eastern friends [---].[b]

Please hurry up. Respectfully,

Geo H Bliss, Gen. Man.

TLS, NjWOE, DF (*TAEM* 18:321). Typed in upper case. Letterhead of Electric Pen & Duplicating Press, George Bliss, General Manager. [a]"Chicago" and "1878." preprinted. [b]Illegible.



From John Griest's patent for a stencil-making pen that competed with Edison's electric pen.

1. Bliss had written Edison on 13 July about the Griest Manufacturing Co. of Chicago, which made and sold treadle-powered duplicating pens based on the 9 March patent application of John Griest, which issued on 15 October as U.S. Patent 208,905. Bliss warned that the device "does fair work and is attracting a good deal of attention. Something will have to be done immediately to shut them up. Their apparatus is a plain infringement." He advised Edison that "the defense of the patent properly belongs to you," and asked permission to retain the Chicago patent attorneys West & Bond, who had been recommended by Lemuel Serrell. In September, this firm sent a bill of complaint to Edison for his signature and he agreed to advance them $200 for their expenses in the case. In the meantime, Bliss reported that Griest, whom he described as "an old patent fighter," had offered to either settle for $5,000 dollars or make a licensing agreement with Edison. In late October, after telling Edison that Griest had again indicated that he would settle for $5,000, Bliss asked for authorization to press the matter in court, which Edison gave him in a letter of 30 October. Bliss to TAE, 13 and 26 July, 2, 11, 16, and 27 Sept., 28 Oct., 30 Dec. 1878; West & Bond to TAE, 6 Sept. 1878; U.S. Pat. 208,905; all DF (*TAEM* 18:304, 307, 319–22, 335, 348; 50:451); TAE to Bliss, 30 Oct. 1878, Lbk. 3:469 (*TAEM* 28:895); advertisement for "Griest's Writing Machine and Duplicating Press" and "Illustration Showing the Griest Writing Machine," Cat. 1241, items 891 and 919, Batchelor (*TAEM* 94:355, 363); advertisement for "Griest's Mechanical Pen and Duplicating Press," Cat. 1032:131, Scraps. (*TAEM* 27:921).

2. In his letter of 2 September, Bliss noted that Griest "retails his machines at 25.00 & 30.00 but sells sample machines at 5.00 less and gives agents 50 per cent discount from list." At the end of December, Bliss complained that Griest was "selling a good many of his duplicating outfits in Chicago, and in fact all over the country. He offered three outfits for $37 to a party here, a day or two ago, which is a fair sample of what is being done while the patent suit is pending and the Huffman patent being reissued." Explaining that it was "necessary to fight him with weapons of his own kind," Bliss told Edison that he was "compelled to put a cheap outfit on the market temporarily" and asked him to "accept a smaller royalty on these cheap outfits." To Bliss's dismay Edison rejected this proposal. Bliss to TAE, 2 Sept. and 30 Dec. 1878, 7 Jan. 1879; Robert Gilliland to TAE, 31 Dec. 1878; all DF (*TAEM* 18:319, 376, 379; 50:372); TAE to Bliss and TAE to Gilliland, both 3 Jan. 1879, Lbk. 4:81 (*TAEM* 80:34).

3. One of these may be the duplicating pen Delancy Louderback described in a 24 September letter to Bliss. DF (*TAEM* 18:334).

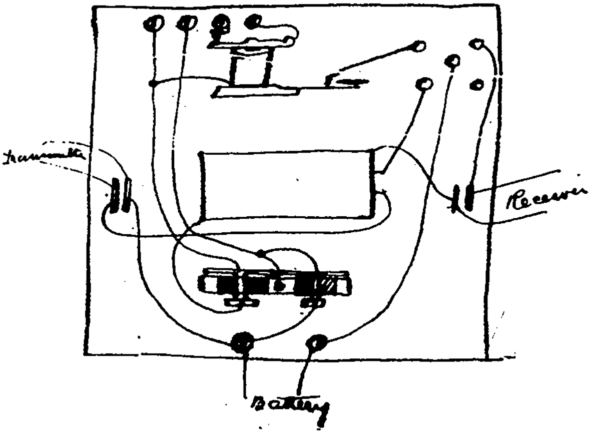
-1431-

Charles Batchelor to James Adams

[Menlo Park,] Sept 11th [187]8

Dear Jim,

I send you a new telephone on bracket. I have put in one of our old receivers, but you must put in its place any you want; and fix something on the end to hold it when you are not using it. This is the instrument adopted by the Gold and Stock Tel Co in New York and there are now about 1000 in use in this country, we ship Carbons to Chicago & San Francisco. I tell you the Carbon telephone has been a 'god-send' for the Phelps and Gray telephones, they have made them by the 1000 and now they find that they can only use [ ][a] Carbon telephones.[1]



This I send you is the one designed for using the Phelps receiver and is made by Phelps but altered a little by me You will find the transmitter vibrates when you talk into it but do not alter it untill you have tried it perfectly if you have to adjust it at all [which I dont?][a] think you will; you will find the nickel plated screw on back is only a 'bogus screw' and after you have taken it out you will find another screw under it which by turning will adjust back or forward. You can take off the bottom board by undoing the two screws and look at connections You will see we have a lightning arrester on them inside. Glad of your success on long lines with Cable "bully boy" push her forward[2] We are doing some big things with electric light just now will let you know something about it soon. ~~We send you transmitter.~~ Yours as ever

Chas Batchelor

P.S. The days of the magneto here are shortening wherever it can be done people want Edison's telephones instead of Bells or any magneto.

The Western Electric are making a very pretty pattern with a Gray receiver and the Construction Co of San Francisco are making them but I have not seen their pattern.

Phelps is running his shop entirely on them and by the time you get here again you will have to visit an exhibition of antiquities to be able to get a glance at a magneto of any kind as a transmsitter. Yours B

ALS (letterpress copy), NjWOE, Batchelor, Cat. 1330:34 (*TAEM* 93:249). [a]Bottom of page not copied.

1. Text is "Transmitter," "Battery," and "Receiver." This drawing is similar to one made by Batchelor on 3 September and identified as "Edison's Carbon telephone as made by W. U. Tel. Co. Desk pattern of Phelps." Cat. 1317:67, Batchelor (*TAEM* 90:690).

2. See Doc. 1429 n. 11

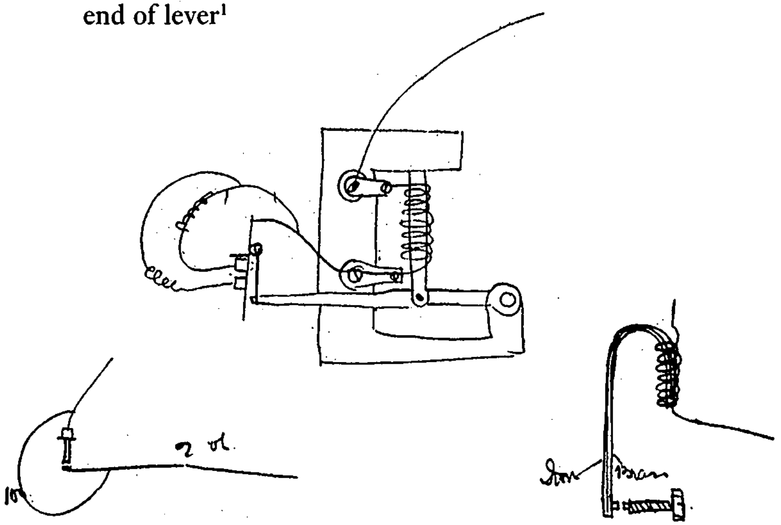
-1432-

Technical Note: Electric Lighting

[Menlo Park,] Sept 11 1878

Electric Light Subdivision

To prevent flickering put in resistance so by little wheel on end of lever[1]



Thin strips of Brass and iron together & bent up in a U shape[2] These are very sensitive &[3]

T A Edison
M N Force

Chas Batchelor
J Kruesi
Stockton Griffin

X, NjWOE, Lab., Vol. 16:12 (*TAEM* 4:492). Written by Batchelor. Copied by William Carman in Cat. 994:120, Lab. (*TAEM* 3:229).

1. Edison had used similar designs in his telegraph and telephone experiments. See Docs. 394 (fig. 3), 754 (fig. 16), and 863 (fig. 37).

2. Text above is "Iron" and "Brass." Edison had previously designed a telephone transmitter in which a combination of iron and brass strips or sheets was the central element (see *TAEB* 3:506 [fig. labeled "Expansion"]). For a related sketch, dated only as "previous to" 25 September 1878, see Vol. 16:43, Lab. (*TAEM* 4:521).

3. This note stops in mid-page.

-1433-

To William Wallace

Menlo Park, N.J., Sept 13 1878[a]

William Wallace

Hurry up the machine I have struck a big bonanza

T. A. Edison

L (telegram), NjWOE, DF (*TAEM* 17:925). Written by Stockton Griffin; letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted.

-1434-

From George Gouraud

[London,] 13 Sept 1878

To Edison[1]

Good Company will take license for English Railways & manufactories only giving amply provision for pushing business immediately[2]— You to have twenty per cent profits with similar protective clauses Nottage contract. They advancing £1000 immediately license is executed, one such company may be speedily followed by others on possibly even better terms so long delayed an early beginning highly important Cable reply[3]

Gourand

L (telegram), NjWOE, DF (*TAEM* 19:914). Letterhead of Direct United States Cable Co., Ltd.

1. This telegram was transmitted by the Direct United States Cable Co., which sent it to Edison.

2. See Doc. 1502.

3. See Doc. 1441.

-1435-

From George Prescott

New York Sep 13 1878[a]

Dear Sir,

Yours of the 11th received.[1] Do just as you think best about correcting or rewriting the article. It ought to be correct in every respect, because when it is published in my book it will go into the hands of every scientist throughout the world. I supposed you would desire to fix the dates of invention, but you can act upon your own judgment in the matter. Take all the time you want to have it perfect in every respect. You had better mention the use of gas carbon buttons instead of those made from lamp black in your Carbon Telephone.[2] This is a clincher on Hughes pretensions. I want to get the article completed soon as possible, but I want to get it exactly right if it takes a month. You will find it an excellent time and place to put yourself right on the record as to the time when you made the invention claimed by Hughes.[3] Yours truly

Geo. B. Prescott

ALS, NjWOE, DF (*TAEM* 17:171). Letterhead of Western Union Telegraph Co., George Prescott, Electrician. [a]"New York" and "187" preprinted.

1. Edison had written Prescott on 11 September, "Do you desire that the article as sent should be corrected or that I shall rewrite it." Earlier that day, Prescott had sent the manuscript and illustrations for the chapter published as "Edison's Recent Telephonic and Acoustic Inventions" in Prescott 1879. DF (*TAEM* 17:168, 16:43).

2. The published chapter was written in the third person, and concluded with a condensed version of Bishop 1878. At least part of the chapter was based on a draft by Edison found in Undated Notes and Drawings, Menlo Park Period, Lab. (*TAEM* 45:123). In that section Edison stated that coarse and inelastic particles of gas retort carbon did not work as well in his telephone as fine grains of lampblack and produced a "harsh and grating" sound. The published chapter ranked other substances (in a slightly different order from Edison's draft) in order of their suitability for the telephone, noting that "All the conducting oxides, sulphides, iodides, and nearly every metal finely divided has been tried by Mr. Edison, in various states of divisibility and mixed with various substances." Prescott 1879, 531–34.

3. The discussion of the microphone in Prescott 1879 (pp. 534–44) began:

> The device of using several pieces of the semi-conductor instead of one was early tried by Mr. Edison. He found, in general, that the loudness of the sound was increased by thus multiplying the number of contact surfaces, but also that the articulation was impaired. Instruments of this nature have since become known as microphones, though it is not probable that faint sounds were ever augmented through their agency so that they could be easily recognized at a distance from their source.

Prescott included illustrations showing "one of the first forms, invented by Mr. Edison, April 1, 1877" and another design, dated 24 August 1877, that "acts both as a transmitter and receiver, the latter fact being discovered by Mr. Chas. Batchelor, Mr. Edison's assistant" (figs. 260 and 266).

-1436-

From William Wallace

Ansonia, Conn. Sept 13th 1878[a]

My dear Sir.

I send you this day one light intensity machine.[1] If you want a quantity machine will send that also. I truly hope you ~~will~~ "have struck a big bonanza" Please be sure the Brushes have good contact with commutator.[2] Yours Respty

Wm Wallace G[3]

LS, NjWOE, DF (*TAEM* 17:925). Letterhead of Wallace & Sons. [a]"Ansonia, Conn." and "187" preprinted.

1. That is, a dynamo with its armature coils wired in series to produce a small current at high voltage or "intensity." In contrast, a "quantity machine," with armature coils in parallel, generates a heavier current at lower voltage. This nomenclature was originally applied to battery cells. It is not known how much Edison paid for the dynamo. King 1962c, 385; *TAEB* 1:96 n. 6.
2. This was to prevent sparking, a serious problem that wasted power and quickly burned the commutators in early dynamos. King 1962c, 372; Thompson 1902, 78–80.
3. Unidentified.

-1437-

From George Barker

Philadelphia Sept. 16. 1878.

My dear Edison:—

I did not have time yesterday to get the things to you as I expected, so I enclose them today. There is in the first place a nice button of tellurium, which Dr. Genth[1] gave me for you. He thinks you could get a tellurium ore which would pay well from the John Jay mine in Colorado.[2] I enclose in the second place some crystalline plates of the graphitoid silicon, which you may find to work as well as the other form. I should like to know if they do work, as this form is made easier than the other. The article in the Sun of this morning (reprinted in the Phila. Bulletin of this evening) suggests that you have made a big strike in electric lighting. Indeed according to the reporter gas stocks must go down now. Mr. Griffin said to me on Sunday[3] that the Wallace machine had reached you. How do you like it? Should you want at any time to make experiments with a Gramme machine, mine is always at your service.

I have been asked to lecture again this winter in the Academy of Music. Should I do so, I would like to lecture on the

Electric Light. Will you have your new things ready & can I show them at my lecture, say by January next? Cordially yours

George F. Barker

Mr. Griffin's letter has just reached me.[4] I hope you will be able to get me a copy of Tuesday's Sun as I want to see what Mr. North wrote.[5]

Will you be good enough to write your autograph on the backs of three of your carte-de-visite photographs and send them to me for your lady friends west?[6]

I will try & see you before long. B.

ALS, NjWOE, DF (*TAEM* 17:927).

1. Frederick Genth was a German-born and educated analytical chemist who taught at the University of Pennsylvania. He was noted for his expertise on minerals and the great accuracy of his analyses. *DAB,* s.v. "Genth, Frederick Augustus."

2. The John Jay mine was located near the former settlement of Jamestown, northwest of Boulder, Colorado. It was one of several profitable mines opened after the discovery of tellurium in the region in 1873. Dallas 1985, 109; Fossett 1880, 254.

3. 15 September.

4. Not found.

5. "Power Flashed by Wire," an article in the 17 September *New York Sun,* discussed generating electricity at Niagra Falls and sending the power throughout New York State; presumably the reporter was "Mr. North." The paper had raised this possibility in its 10 September account of Edison's Ansonia trip, in which it attributed to Edison the belief that "power may be transmitted from one point to another as though it were a telegraphic message." The latter article was reprinted the same day in the *New York Mail* as "A Great Triumph," which Charles Batchelor put in a scrapbook (Cat. 1241, items 878, 889, Batchelor [*TAEM* 94:349, 354]).

"Power Flashed by Wire" included a letter disputing the practicality of long-distance transmission. The letter-writer argued that the heavy copper cables needed to carry the current, and the inefficiencies of the Wallace machine, would make the project prohibitively expensive. He concluded that "Electro motors are, and always have been, failures, and the 'telemachon' adds one more to the long list." The article reported that when Edison read this letter, he laughed and stated that its author had "shown himself profoundly ignorant on the subject of dynamo-electric machines. The very poorest and least perfected of all the power and light transmitting machines I ever saw or read of have given much better results than those which he attributes to the Wallace machine, which, in its now perfected state is superior to any other thing of the kind ever projected." Edison claimed that the telemachon would "be able to transport the power of a river or tide way above its source; in fact, over hills and mountains." He then made a series of calculations showing that it could do so economically. Charles Batchelor clipped from the 23 September *New York Sun* the letter-writer's rebuttal, signed

"S"; he has not been identified. Cat. 1241, item 903, Batchelor (*TAEM* 94:359).

6. Unidentified.

-1438-

Charles Batchelor to James Adams

Menlo Park, N.J. Sept 16 1878

Dear Jim,

Yours received.[1] I told Ellen you would not be home till spring. I think she will be satisfied as long as she knows you cannot leave. It will be impossible for me to come over; do the best you can, glad you are working successfully. Gold and Stock are using nothing else but they work them very low not anything like ours (however we dont care a continental what they do with it as long as they pay all right. We are almost rid of telephones now Bergman makes for foreign countries and they are sold by McKenzie[2] who is agent for the "pen" now in New York. By the way Jim you ought to try and get a little money out of Bliss; I've been trying but cannot yet but he might arrange for Beetle to give you some, You know you want to scoop in all you can, and I am afraid we shan't get much from him anyway, dont tell him I told you to, because I am trying myself. We have struck a big thing on Electric Light & I think we have solved the problem of the subdivision of it so that we can make as many lights of small power as we like instead of one light of great power as others have always done we are working night and day on it now. If anyone asks you about Electric light and what Edison is doing in it you can tell them he has just solved the problem of the subdivision of the light indefinitely but it will not be shown till patents are all secure I will send you description. Did you get that book?[3] If not I will send you another.

In making our carbons I forgot to tell you that we powder the lamp black and sift it very fine, and then press it up; and then powder it up & sift it again; we do this three times so that when pressed for last time it is very delicate. Can you speak French yet? Ellen is well. Rosa & kids all well Yours as ever

Chas Batchelor

Send you "Sun"

ALS (letterpress copy), NjWOE, Batchelor, Cat. 1330:38 (*TAEM* 93:252).

[1] Doc. 1418.

[2] James MacKenzie.

[3] See Doc. 1391.

-1439-

Anonymous Article in the New York Sun[1]

New York, September 16, 1878.

EDISON'S NEWEST MARVEL.[a]

SENDING CHEAP LIGHT, HEAT, AND POWER BY ELECTRICITY.[a]

Illuminating Gas to be Superseded—Edison Solving the Problem of Dividing the Too Great Brilliancy from an Electric Machine.

Mr. Edison says that he has discovered how to make electricity a cheap and practicable substitute for illuminating gas. Many scientific men have worked assiduously in that direction, but with little success. A powerful electric light was the result of these experiments, but the problem of its division into many small lights was a puzzler. Gramme, Siemens, Brush, Wallace,[2] and others produced at most ten lights from a single machine, but a single one of them was found to be impracticable for lighting ought save large foundries, mills, and workshops. It has been reserved for Mr. Edison to solve the difficult problem desired. This, he says, he has done within a few days. His experience with the telephone, however, has taught him to be cautious, and he is exerting himself to protect the new scientific marvel, which, he says, will make the use of gas for illumination a thing of the past.

Mr. Edison, besides his power of origination, has the faculty for developing the ideas and mechanical constructions of others. He visited the Roosevelt pianoforte factory in this city, and, while examining the component parts of the instruments, made four suggestions so valuable that they have been patented.[3] While in the mining district of the West, recently, he devised a means of determining the presence of gold below the surface without resorting to costly and laborious boring and blasting.[4] While on a visit to William Wallace, the electrical machine manufacturer, in Ansonia, Conn., he was shown the lately perfected dynamo-electric machine for transmitting power by electricity. When power is applied to this machine, it will not only reproduce it, but will turn it into light. Although said by Edison to be more powerful than any other machine of the kind known, it will divide the light of the electricity produced into but ten separate lights. These being equal in power to 4,000 candles, their impractibility for general purposes is apparent. Each of these lights is in a substantial metal frame, capable of holding in a horizontal position two carbon plates, each twelve inches long two and a half wide, and one-half thick. The upper and lower parts of the frame are insulated from each other, and one of the conducting wires is connected with each carbon. In the centre, and above the upper carbon, is an electro magnet in the circuit, with an armature, by means of which the upper carbon is separated from the lower as far as desired. Wires from the source of electricity are placed in the binding posts. The carbons being together, the circuit is closed, the electro magnet acts, raising and lowering the upper carbon enough to give a bright light. The light moves toward the opposite end from which it starts, then changes and goes back, always moving toward the place where the carbons are nearest together. If from any cause the light goes out, the circuit is broken, and the electric magnet ceases to act. Instantly the upper magnet falls, the circuit is closed, it relights, and separates the carbon again.

Edison on returning home after his visit to Ansonia, studied and experimented with electric lights. On Friday last his efforts were crowned with success, and the project that has filled the minds of many scientific men for years was developed.

"I have it now!" he said, on Saturday, while vigorously turning the handle of a Ritchie inductive coil[5] in his laboratory at Menlo Park, "and, singularly enough, I have obtained it through an entirely different process than that from which scientific men have ever sought to secure it. They have all been working in the same groove, and when it is known how I have accomplished my object, everybody will wonder why they have never thought of it, it is so simple. When ten lights have been produced by a single electric machine, it has been thought to be a great triumph of scientific skill. With the process I have just discovered, I can produce a thousand—aye, ten thousand—from one machine. Indeed, the number may be said to be infinite. When the brilliancy and cheapness of the lights are made known to be public—which will be in a few weeks, or just as soon as I can thoroughly protect the process—illumination by carbureted hydrogen gas will be discarded. With fifteen or twenty of these dynamo-electric machines recently perfected by Mr. Wallace I can light the entire lower part of New York city, using a 500 horse power engine. I purpose to establish one of these light centres in Nassau street, whence wires can be run up town as far as the Cooper Institute,[6] down to the Battery,[7] and across to both rivers. These wires must be insulated, and laid in the ground in the same manner as gas pipes. I also propose to utilize the gas burners and chandeliers now in use.[8] In each house I can place a light meter, whence these wires will pass through the house, tapping small metallic contrivances that may be placed over each burner. Then housekeepers may turn off their gas, and send the meters back to the companies whence they came. Whenever it is desired to light a jet, it will only be necessary to touch a little spring near it. No matches are required.

"Again, the same wire that brings the light to you," Mr. Edison continued, "will also bring power and heat. With the power you can run an elevator, a sewing machine or any other mechanical contrivance that requires a motor, and by means of the heat you may cook your food. To utilize the heat, it will only be necessary to have the ovens or stoves properly arranged for its reception. This can be done at trifling cost. The dynamo-electric machine, called a telemachon, and which has already been described in THE SUN,[9] may be run by water or steam power at a distance. When used in a large city the machine would of necessity be run by steam power. I have computed the relative cost of the light power and heat generated by the electricity transmitted to the telemachon to be but a fraction of the cost where obtained in the ordinary way. By a battery or steam power it is forty-six times cheaper, and by water power probably 95 per cent. cheaper."

It has been computed that by Edison's process the same amount of light that is given by 1,000 cubic feet of the carbureted hydrogen gas now used in this city, and for which from $2.50 to $3 is paid, may be obtained for from twelve to fifteen cents. Edison will soon give a public exhibition of his new invention.

PD, NjWOE, *New York Sun*, 16 Sept. 1878, [3]. In Batchelor, Cat. 1241:887 (*TAEM* 94:354). [a]Followed by centered horizontal line.

1. This article was most likely written by Amos Cummings.

2. Zénobe-Théophile Gramme, the Siemens Brothers firm, Charles Brush, and William Wallace were among the early commercial manufacturers of dynamo-electric generators.

3. Hilborne Roosevelt's pipe organ shop was on W. 18th St. (*Wilson's Business Directory of New York City* 1879, 541). Nothing is known of any such patents; Edison did not receive them.

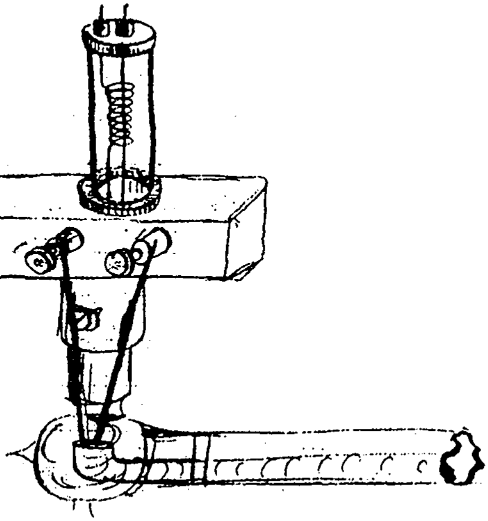
4. See Doc. 1393 n. 4.

5. A powerful coil in which the windings are placed in parallel disks in order to prevent internal arcing. It was designed by Edward Ritchie and made by Ritchie & Sons of Boston. See *TAEB* 1:82 n. 11.

6. The Cooper Union for the Advancement of Science and Art, on Eighth St. at Fifth Ave.

7. The Battery, named for the battery of guns at the fort built by Dutch settlers, is at the southern end of the city at the foot of Broadway. From 1855 to 1890, when the Ellis Island facility opened, it was the east coast federal immigration center. Jackson 1995, s.v. "Battery Park."

8. Shortly before this article appeared, Charles Batchelor began to draw electric lights mounted on gas fixtures. One sketch of 17 September shows a gas pipe used as the conduit for lamp wiring. Vol. 16:24, Lab. (*TAEM* 4:504); see also Vol. 16:9, 10, 25, 31, Lab. (*TAEM* 4:488, 490, 504, 510).



Design for an electric light using a gas fixture.

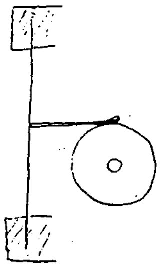
9. The 10 September *New York Mail* reprint of the *New York Sun's* report of the same day on Wallace's dynamo is in Cat. 1241, item 878, Batchelor (*TAEM* 94:349). The *Sun's* report was also widely reprinted in Britain.

-1440-

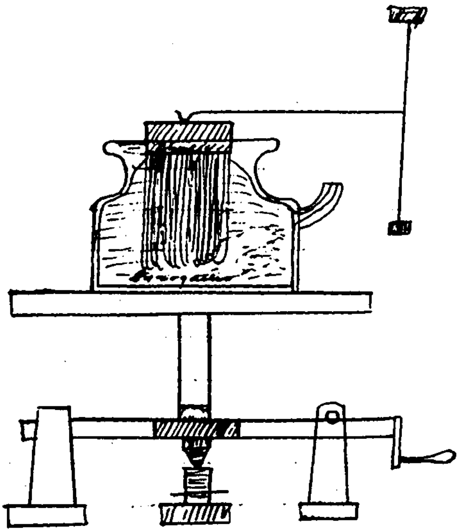
Menlo Park Sept 16th 78

Technical Note: Telephony

"New Receiver"[1]



finly powdered chalk—[2]
" " " mixed with Dextrine
" " " " " Lamp Black
" " " " " Black Lead[3]
Sulphate of B[aryta].
Olive Oil & Pyrogalic[4] "
Nitrate Uranium—dissolve in Gly[cerine]—Olive oil[a] Oil Mur~~p~~baine[5]
" Magnesia " " " " "



Chalk[6] and Pyro[b] good—a wick in vessel which attracts the pyro[b] up to chalk by capilliary attraction, consequently keeping chalk moist[7]

T A Edison
Chas Batchelor
Martin Force

Chas P Edison
J Kruesi
G E Carman

X, NjWOE, Lab., Vol. 18:6 and Cat. 996:77 (*TAEM* 4:1050, 3:317). Written by Charles Edison. Copied by William Carman in Cat. 996:77, Lab. (*TAEM* 3:317). [a]"Olive oil" interlined above. [b]Obscured overwritten letters.

1. Edison had experimented briefly with electromotograph telephone receivers in June, but this note represents the beginning of an intensive period of research, largely conducted by his nephew Charles Edison, on the chemical and physical composition of the electromotograph contact surfaces.

2. Edison had made extensive experiments with chalk and other "porous substances to replace Paper in the E.M.G." during August and September 1876 in an effort to develop a repeater for very high-speed telegraph signals (see Docs. 780–81, 783–84, and 786). During the last two weeks of September 1878 he had his nephew again test many of the substances and solutions tried in these earlier experiments (Vol. 18:7–8, 11, Lab. [*TAEM* 4:1051–52, 1055]).

3. For comparisons among lampblack, black lead, and other forms of carbon commonly used in Edison's experiments see *TAEB* 3:112 n. 1.

4. Edison had used pyrogallic acid extensively in his earlier electromotograph experiments.

5. Oil of mirbane, i.e., nitrobenzene. Edison had used it in some previous electromotograph experiments (e.g., Doc. 573).

6. The text below the vertical striations is "pyrogallic." On the original the striations are labeled "wick" and the rectangle above them is labeled "chalk."

7. The following day Charley listed a number of other substances, among which were acetate mercury and caustic potash. On 22 September he recorded that "Chalk—saturated with Solution of caustic Soda pyro-glycerine—and acetate mercury" was "very good." By 11 October, he had developed a standard button consisting of chalk, acetate mercury, and a saturated solution of caustic soda and began extensive experiments to arrive at the best amounts of each to use. Vol. 18:7–8, 10–11, 32, 49–50, 52–53, Lab. (*TAEM* 4:1051–52, 1054–55, 1084–85, 1087–88).

-1441-

To George Gouraud

[Menlo Park,] 17 Septr 1878

Geo E Gouraud

Send license papers—will sign and forward—[1] Make it twenty per cent royalty instead of profits—latter unknown quantity—

T A Edison

L (telegram; copy), NjWOE, DF (*TAEM* 19:915). On "Copy Telegram" form of George Gouraud; form is electric pen copy.

[1] Gouraud sent this copy of the telegram to Edison with a letter of 21 September in which he stated that "the papers are now in the hands of the lawyers—and I will hasten their completion and send them to you as soon as possible" DF (*TAEM* 19:915); see also Doc. 1502.

-1442-

To Orson McCall[1]

Menlo Park, N.J., Sept 18 1878[a]

Dear Sir

Upon arriving from N.Y. today I learned from Mr Batchelor that you had been here. He informs me that you spoke of some alterations which you thought should be made— I consider the engine practical as it stands and in such shape that any intelligent mechanic can make them, or change it as may be desired.[2] We have no time here to waste on such details— Will you please write what disposition you want made of the ~~engine~~Lamp?[3] Very Truly

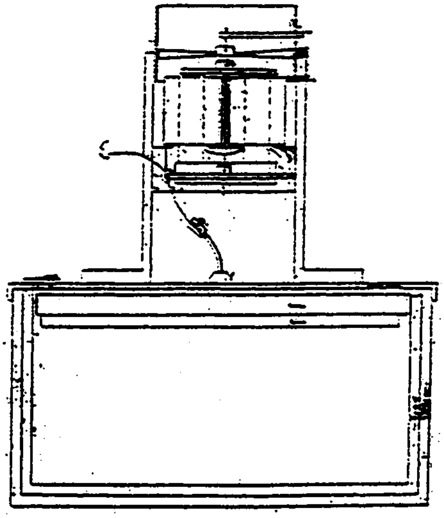
T. A. Edison G[riffin]

L (copy), NjWOE, DF (*TAEM* 16:80). Written by Stockton Griffin; letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted.

[1] Orson McCall was president of the McCall Manufacturing Co. in New York City. His letterhead identified the firm as makers of lamps and burners. Wilson 1879, 893; *TAEM-G1*, s.v. "McCall, O. G."

[2] Laboratory workers built a chimneyless kerosene lamp in which a small electric motor turned a fan to create the draft. This was not a new

idea; Edison had sketched such a device nearly two years earlier (see *TAEB* 3:212 n. 4). On 4 September, McCall inquired "How comes on the engine or motor for the Lamp. I am quite anxious regarding it and very sanguine of a speedy financial success if you can accomplish the result desired." He planned to visit the laboratory on 18 September "to see the engine. Shall want to bring it away with me you know, to adjust the Bowl to it &c" (McCall to TAE, 4 and 16 Sept. 1878, DF [*TAEM* 16:10, 67]). A measured drawing dated 9 September shows the battery inside the fuel bowl at the base of the lamp. This drawing, with the notation "Made by [George] Jackson," is probably the one from which McCall's lamp was made (Cat. NS-78-005, Lab. [*TAEM* 7:812]). Related sketches from around this time, including Batchelor's instructions to Kruesi for making the battery, are in Cat. NS-78-005, Lab. (*TAEM* 7:807–11).



Charles Batchelor's measured drawing of Edison's chimneyless kerosene lamp in which an electric fan created the draft.

3. McCall replied on 19 September that when Edison next came to New York, "I desire to see you a moment then when I will indicate to you my very reasonable desires in the matter mutually interesting to us." Nothing further is known of this project. DF (*TAEM* 16:88).

-1443-

From George Prescott

New York, Sep 18 1878[a]

My dear Edison

Yours of the 17th received.[1] I will hold my book back until your new matter comes to hand.

Our cables are seriously troubled by induction between the wires, and what is said on one of your telephones on one wire, can be heard on all the others. Can you suggest any remedy. The matter is very serious especially for wires between here and Brooklyn. Yours truly

Geo. B. Prescott

⟨It may be possible to compensate in the cable house by magnets or condensers, Focault cable[2] with foil on the outside of each conductor might do the business. I remember Ludwig[3] trying this about 9 year ago in old A&P office. will talk the matter over when I see you—was in today 3 ~~d~~times but you were out= E⟩

ALS, NjWOE, DF (*TAEM* 19:764). Letterhead of Western Union Telegraph Co., George Prescott, Electrician. [a]"New York," and "187" preprinted.

1. Not found.

2. What Edison meant by this is unknown.

3. It is not known if Edison is referring to L. A. Ludwig. In 1869 Edison had conducted tests of his double transmitter on the New York to Rochester line of the Atlantic and Pacific Telegraph Co. See Docs. 61, 63.

-1444-

To John Browning[1]

[Menlo Park,] Sept 19th [187]8

Dear Sir

Your kind favor of the 7th inst was duly rec'd.[2] I was disappointed in not being able to send you a Tasimeter in the package which I forwarded to my London agent a few days since. The instrument used during the eclipse was left with the scientists who were assembled in convention at St Louis during the latter part of August. I have advice that this instrument will reach me today or tomorrow and I will lose no time in having it packed and forwarded to your address. I wrote Prof Barrett to allow you to take drawings of the tasimeter which I sent him and also to give you a diagram of connections and twenty carbon discs

I do not wish to receive any royalty on instruments of a purely scientific character[3] and as for payment for the tasimeter which I send you and for any instruments sent you in the future you may if you choose send me something from your stock of what you consider about equal value—I shall not be exacting. As for the carbon discs they are inexpensive—I will take pleasure in furnishing all you may require at any time. The Tasimeter was made in my laborator which you will understand is not a manufactury The machine shop is merely conducted to make models—I mention this to account for any short-comings in the instrument. Very Truly

Thomas. A. Edison

LS (letterpress copy), NjWOE, Lbk. 3:376 (*TAEM* 28:812). Written by Stockton Griffin.

1. John Browning's letterhead identified him as an "Optical and Physical Instrument Maker to Her Majesty's Government, The Royal Observatory, The Royal Society, and the Observatories of Cambridge, Utrecht, &c., &c" (see also de Clercq 1985, 5, 24, 67, 88, 112). Over the summer Edison had sent Browning at least two news accounts and two journal articles about his inventions and the microphone controversy (Cat. 1308:282, 287, Batchelor [*TAEM* 90:786]). On 19 July, Browning thanked Edison for his "kindness in forwarding me copies of various journals containing full accounts with illustrations of your numerous and important inventions— brief references to them have appeared in many of the English journals mostly accompanied by very unsatisfactory engravings" (DF [*TAEM* 15:962]).

2. Browning had thanked Edison for agreeing to send a tasimeter. He promised to "do my best to produce copies of the instrument that shall be satisfactory in their performance, and this with your kind assistance in forwarding the Carbon discs I hope I shall achieve—and on every instrument shall be engraved 'Edison's Tasimeter made by John Browning.'" Browning planned to exhibit the device "at the Soirees of the principal scientific societies during the Winter months." Browning to TAE, 7 Sept. 1878, DF (*TAEM* 16:25).

3. In his letter of 7 September (see note 2), Browning offered to pay Edison a "royalty on any instrument of yours I may manufacture, whether patented or not." He also promised to send "a miniature microscope which after many trials I have just produced I trust it may be of some service to you. I know it will interest you, or some of your friends."

-1445-

From Tracy Edson

New York Sept 19 '78

Dear Sir,

I would like to see you at the above address;[1a] at your earliest convenience— I have something to say to you of so much importance to you and myself, that I wish you would appoint an early day, say Saturday next at 11. o'clk to meet me as above,—[2] As you will readily imagine, it is in relation to your new discovery, of which you spoke to me on Monday last. Very Truly Yours

Tracy R. Edson[3]

ALS, NjWOE, DF (*TAEM* 18:2). [a]Obscured overwritten letter.

1. Edson wrote from room 22 on the second floor of the Western Union building in New York.

2. Edson wanted to discuss financial backing of the electric light. On Saturday, 21 September, he inquired whether Edison would keep their appointment and Edison wired back: "Cant come over today, cant you come out next monday or tuesday." Edson agreed to come to Menlo

Park on Monday morning, but apparently that meeting was again rescheduled for Tuesday, 24 September, in New York. That day, Edison telegraphed that he had been "Up all night on light cannot come will see you tomorrow," and also broke an appointment with Grosvenor Lowrey for that evening. Edison also arranged a 24 September meeting with Hamilton Twombly, another Western Union financier interested in the electric light; it is unclear whether this conference was to be held privately or with Edson. Edson to TAE and TAE to Edson, both 21 and 24 Sept. 1878; Stockton Griffin to Lowrey, 24 Sept. 1878; Twombly to TAE and TAE to Twombly, both 24 Sept. 1878; all DF (*TAEM* 18:3, 7–8; 97:695).

3. Tracy Edson had amassed a fortune on royalties from patents used in printing United States currency. He had become a director of the Gold and Stock Telegraph Co. shortly after its formation and had helped guide the company into its affiliation with Western Union. At this time he sat on the boards of directors of Gold and Stock and the American Speaking Telephone Co. See *TAEB* 1:235 n. 1.

-1446-

Telegrams: To/From Grosvenor Lowrey

September 20, 1878[a]
Menlo Park, N.J.,[b] 9:08 AM

Grosvenor P Lowrey

Batchelor out taking Phonautograph records. cannot finish immediately. If possible get a little delay as I want to appear before jury with records if good ones;[1] answer:

T. A. Edison

[New York] 10:11 AM[2]

T A Edison

Come right away whether you are ready or not If you arrive after eleven go right to Grand jury room Brown Stone building in Park on Chamber street answer

G. P. Lowrey

ALS and L (telegrams), NjWOE, DF (*TAEM* 16:93, 95). Letterhead of T. A. Edison. [a]Date from document, form altered. [b]"Menlo Park, N.J.," preprinted.

1. On 19 September, Lowrey had telegraphed Edison: "Grand Jury meet tomorow at Eleven If you are not ready send telegraph stating that you desire to appear and why you are not ready. Send a dispatch on which I can ask postponement to three Broad St." This was the address of Porter, Lowrey, Soren & Stone. DF (*TAEM* 16:92).

The grand jury was considering indictments against the Metropolitan Elevated Railroad (see Doc. 1371 n. 1), and Edison was invited to appear as an expert witness. In preparation, Batchelor took phonautograph recordings of train noise at various points along the Metropolitan line and other railroads on 19 and 20 September. However, Edison told reporters that he needed more time to analyze the tracings under a microscope and apparently never testified in the case. "Broadway and Ann Street. Stop That Noise," *New York Herald,* 20 Sept. 1878; "The Noise on Sixth Avenue," *New York Daily Tribune,* 21 Sept. 1878, Cat. 1241, items 900–1, Batchelor (*TAEM* 94:358–59).

2. This telegram was preceded by one at 10:00 A.M. from George Scott, who wired Edison: "Mr Lowrey wants you to come to the grand jury room immediately whether you have prepared yourself or not" (DF [*TAEM* 16:94]). At 2:50 that afternoon, Alfred Mayer, also expected as an expert witness, telegraphed Edison that he would be unable to testify (DF [*TAEM* 16:96]).

-1447-

From George Bliss

Chicago Sept 21, 1878[a]

Dear Edison:

I expected to be in New York ere this but Beetle who was to have left on the 7th has not reported himself on the way.[1] I dont want to make two trips down. Beetle represents that he is coming over backed by capital to buy the Pen patents. He says Bailey is furnishing Puskas money and that His friends are ready to pay a large sum for the carbon telephone but Bailey won't give any satisfaction. I take very little stock in Beetle's yarns. He says Roosevelt is on the way over etc. Now I dont want any tricks played on me in this foreign pen business. As stated to you when here I believe Story at Brussels is the best man to run the European business. His workmen turn out elegant samples. He has sold more pens in Europe than any one else. His large Sewing Machine Experience qualifies him to run agencies. He prefers goods from this side rather than the Paris make! What kind of goods can they make in Paris? He has applications for pen agencies from all over Europe. He sends me an order for 50 No. 3 outfits this week. If things really are mixed in Paris it will be a wise thing to keep the Pen out of the mess and it is just as well to smash any ring formed there to control. It cant hurt you to have only good independent business run on its merits but will help the market on other things. If I ever get rid of Beetle shall commence to make money in the Pen business. This having been the opening wedge to you for outside business a little careful nursing will do no harm. Breckon has arranged with one of the large Sewing Machine Cos to run the Pen business in England.[2] Shall be down or write soon. Respectfully,

Geo. H. Bliss

How is Aleck?[3]

~~Breckon~~ Story being in a neutral country politically is to his advantage.[4]

ALS, NjWOE, DF (*TAEM* 18:323). Letterhead of Electric Pen & Duplicating Press, George Bliss, General Manager; letterhead and dateline are electric pen copy. [a]"Chicago" and "1878" preprinted.

1. Charles Batchelor had reported to James Adams that Bliss "recalled Beetle 20th of June but he has the priviledge of 3 months notice so he cannot get him back unless Beetle likes to come." Batchelor to Adams, 14 Aug. 1878, Cat. 1330:25, Batchelor (*TAEM* 93:240).

2. On 2 November, John Breckon wrote Edison that he expected the Taylor Patent Sewing Machine Co., "a substantially and highly respectable firm," to increase sales of the electric pen in England "very considerably during the next few months." DF (*TAEM* 18:349).

3. Unidentified.

4. The Treaty of San Stefano had ended war between Russia and Turkey in March, but its terms threatened to draw Great Britain, Austria-Hungary, and Germany, as well as Russia and Turkey, into a general war over the partitioning of Balkan regions and naval access to the Black Sea. The Congress of Berlin, which ended in July, eased the crisis without definitively settling the territorial questions. Taylor 1971, 241–54.

-1448-

From Uriah Painter

New York, 9–21 1878[a]

Dear Sir

I find that C B Harris is making small Phonographs & has announced his intention of putting them on the market.[1] I have seen his model in your workshop, & it is a clear violation of our license, & he was so informed when he commenced it. I have evidence that he has said he meant to put a thousand on the market before ~~he~~ we knew it— Under our contract with you, the expense of stopping infringers is to be deducted from your royalties, unless we have some satisfactory assurances that he will not do anything with his model, we will be compelled to take him into the United States Court at once—an early answer will oblige[2]

U H Painter of Ex Com' Ed'n Phono Co

ALS, NjWOE, DF (*TAEM* 19:124). Letterhead of Edison Speaking Phonograph Co. [a]"New York," and "18" preprinted.

1. These were never put on the market. Henry Coffin, representing the New York and Paris Fashion Co., did contact Edison regarding "an arrangement with Mess Russell & Harris" to manufacture toy phonographs, but the monthly statements from Oliver D. Russell regarding the Toy Phonograph Co. indicate that no such instruments were ever manufactured or sold. Coffin to TAE, 27 Sept. and 11 Nov. 1878, DF (*TAEM* 19:126, 148); *TAEM-G1–2*, s.v. "Russell, Oliver D.," items listed under "Legal Statements and Testimony."

2. Batchelor replied to Painter later this day: "Letter sent to Bailey

this morning restraining him from employing counsel for Edison. Man has taken small phonos in today. From the way Edison looks at it I dont think it would be advisable to sue Harris, & I think you can buy his experiments cheaper than it would cost you to sue. Edison thinks with me that if you would put the 'phono' into shape like that you could sell 100 where you sell one now." Cat. 1330:40, Batchelor (*TAEM* 93:254).

-1449-

From Theodore Puskas

Paris 2:40 PM Sep 21st 78

Edison[a]

Telephone contract for France signed today fifty thousand francs at your disposition on delivery leicense, 150 thousand later, and 250 thousand in shares.[1] Keep terms private at presant. shall I mail you papers to sign and statement of Phonograph Exhibition, or can you come to receive money and grand prix yourself[2] please come

Puskas

L (telegram), NjWOE, DF (*TAEM* 16:105). Written by Charles Edison; letterhead of T. A. Edison. [a]"Cable" appears above.

1. This agreement, dated 21 September, was between Puskas, Joshua Bailey, and the French merchant Georges Godillot, who agreed to set up a company to exploit the telephone patents of Edison, and also of Elisha Gray, subject to the approval of a designated technical expert who would examine the patents. Puskas described Godillot as "the great Army Contractor in France" and told Edison that "he went into the affair not merely on a Spec—but he believes in the future of the Telephone and is enthusiastic about it." He also claimed that he agreed to combine with Bailey because he believed that "a fusion of the [te]lephones—with and without battery (to cover the whole field)—would bring us a better price." Agreement of 21 Sept. 1878; Puskas to TAE, 25 Sept. 1878; both DF (*TAEM* 19:916, 930).

In the 21 September agreement, Godillot agreed to bring in additional co-partners to provide most of the total 200,000 francs and, on 5 December, four other Parisian investors joined him in a new agreement with Puskas and Bailey to establish the Société du Téléphone Edison. The new investors were civil engineers Alfred Berthon and Alfred Chatard, dentist Thomas Evans, and Alphonse Brancy, a member of the Legion of Honour who was listed as a "propriétaire." The initial fifty thousand francs was not actually put at Edison's disposal until 5 December. Puskas to TAE, 24 and 30 Nov., 5 Dec. 1878; agreement of 5 Dec. 1878; all DF (*TAEM* 16:474, 494, 19:980–81).

2. On 23 September, Puskas mailed a copy of the telephone agreement, an assignment to Edison of half of any profits Puskas derived from it, a power of attorney for the French telephone patent, and a statement of profits from phonograph exhibitions in France which showed net profits of 36,175.40 francs on exhibitions between 23 April and 23 September. He sent another copy of the power on 25 September. DF (*TAEM* 16:110; 19:315, 916–32).

-1450-

From George Walker

New York, Sept 21st 1878[a]

Dear Sir,

Yours of the 18th[1] is received and I have instructed Mr Phelps and Mr Barton to have the words "Edison Carbon Telephone" conspicuously placed on every one of your instruments hereafter made. I do not know how the oversight occurred, for it was distinctly agreed in the contract between you and the W.U. Co. that this should be done,[2] and we are as anxious as you can be that the instruments should bear your name. The success of them is everywhere extremely gratifying.

Our Executive Committee declined to give Mr Johnson the free use of your instruments for exhibition, but I will bring before them the fact that you recommend it and perhaps they may change their views.[3]

We are making exhibitions of it with great success at the American Institute,[4] and we are also exhibiting it at Mechanics' Fairs in Boston and Baltimore.[5]

It is a long time since I saw you,— come and see me when you are in town. Yours very truly,

George Walker Vice Prest.

ALS, NjWOE, DF (*TAEM* 19:768). Letterhead of Gold and Stock Telegraph Co., George Walker, Vice President. [a]"New York," and "187" preprinted.

1. Not found.

2. This provision was made in paragraph fourteen of the 31 May 1878 contract between Edison and Western Union. Miller (*TAEM* 28:1118).

3. There is no evidence that the committee reconsidered Johnson's request.

4. The American Institute, located in New York City, was chartered in 1829 to encourage industry in the United States. It held an annual exhibition of manufacturing, invention, and agriculture. Its 1878 exhibition opened 11 September on East 63rd St. Wilson 1893, 435; "The American Institute Fair," *New York Times*, 9 Sept. 1878, 8.

5. According to George Bliss, Edison's electric pen was also to be exhibited at the Boston fair beginning in late August or early September. Nothing further is known of these events in either city. Bliss to TAE, 26 Aug. 1878, DF (*TAEM* 18:318).

-1451-

Telegrams: From/To Theodore Puskas

September 22, 1878[a]
Paris

Edison[b]

Please answer yesterdays cable and come[1]

Puskas

Menlo Park 10:30 AM[c]

Puskas.

Good— Send Papers. cannot come have struck a bonanza in Electric Light indefinite subdivision of light. Shall Serrell take patents [——][d] for continent same as ~~others~~ before.[2e] Send authorization.

Edison

Paris 5:20 [PM]

EDISON[b]

Thanks will send Serrell immy funds[3]

Puskas

L (telegrams), NjWOE, DF (*TAEM* 16:106). First telegram written by Charles Edison; third telegram written by Stockton Griffin; both on letterhead of T. A. Edison. [a]Date from document; form altered. [b]"Cable" appears above. [c]Time possibly written by Charles Edison. [d]Canceled. [e]Interlined above.

1. Doc. 1449.
2. That is, the same as phonograph and telephone patents in Europe.
3. In a cable of 24 September, Puskas stated that Serrell would have the funds on 7 October and asked to include patents for England as well. Edison replied on the 25th that that was not possible. DF (*TAEM* 16:138, 142).

-1452-

From James Redpath

New York Sept. 23—78

Dear Mr Edison:

I go to Boston to night. If you have made any further experiments with your Ink for the Blind[1] I wish you wd mail me a few samples & I will go over to the Blind Asylum & see whether the pupils can read it.

My address will be at the Parker House[2] I shall be there a week.

Royalties on Exhibitions up to date amount to over 7000^{x}/_{x}$[3]

If you wd send me a small bottle of the ink by xp. I shd like to try it on the Blind. Yours try

James Redpath

If the Blind Ink works with me I shall get lots of notices of it in the N.[ew] E[ngland] papers

By the way: I use your copying ink[4] without dilution for this & all my business letters of my own business. It is splendid—for lazy men. It does not need the exertion of muscle to get a magnificent copy: & I believe in the "conservation of force" when it comes to hard work requiring muscle! There's millions in it if it were pushed through the trade.

ALS, NjWOE, DF (*TAEM* 16:118).

1. In 1877, Edison had thought of writing on sized paper with arsenic acid to produce raised characters that a blind reader could feel. In a series of experiments at the laboratory on 2 September 1878, Charles Edison had experimented on paper treated with various substances to increase the acid's effect. He saturated heavy papers with nearly 240 different substances, then tried writing on them with the arsenic acid. Most materials gave unsatisfactory results. Doc 934; NS-78-006, Lab. (*TAEM* 7:855–59).

Following a report in the 29 August *New York Sun,* Edison received a few inquires about his blind ink. Miss B. U. Fitz Hugh wrote twice from the New York Institution for the Instruction of the Deaf and Dumb asking how to obtain a sample. Edison noted in the margin of her second letter, "Unfortunately the Ink is composed of a concentrated solution of Arsenic acid. You must be careful with it & I am trying to get a harmless substitute." "Four Hours With Edison," Cat. 1240, item 859, Batchelor (*TAEM* 94:339); Fitz Hugh to TAE, 11 Sept. and 10 Oct. 1878; George Allen to TAE, 16 Sept. 1878; all DF (*TAEM* 16:41, 214, 62).

2. Parker House on School Street in Boston had been called "the best hotel in America" by Charles Dickens. *Boston* 1892, 28.

3. After Redpath deducted his salary, the net receipts totaled $5,159.55, of which Edison received his twenty percent royalty of $1,031.91. Edison Speaking Phonograph Co. royalty statement for December 1878, DF (*TAEM* 19:204).

4. See *TAEB* 3:210; Docs. 825, 836.

-1453-

From William Barrett

Stephen's=green, Dublin, Sept 24. 1878[a]

My dear Sir,

I have just received your kind letter[1] in reply to mine and have written to Col. Gouraud to have the 'tasimeter' sent to Birmingham for my lecture.[2] Thank you extremely for your great kindness in sending me one. I already was having one made & have had numerous diagrams of your discoveries made for these lectures. I am not quite sure of the exact date of your Electromotograph,—was it 1874? for that was also a form of telephone: & if so you come next to Reiss[3] in point of date: You shall see my opinion concerning the microphone affair when my lectures are published, meanwhile I will send you a copy of the next "Good Words" containing my article on the Microphone and a popular reference to your work & connexion with it.[4] I am sorry ~~for~~ that any strong words were used, & I don't think Hughes or Preece are at all capable,—the latter I know personally ~~to be~~[b] is not,—of piracy or unfair dealing. Possibly you may be able to see your way to some explanation which will satisfy the public here. In my own opinion there cannot be a doubt you first applied after rediscovering the principle which underlies your carbon telephone & the microphone.

I have just made your paper "megaphone" for my lectures & it answers well; & I shall let you know how the tasimeter works.

I will attend to your wishes concerning Browning. There is an excellent & clever mechanician here by name 'Prescott' whom I employ for good work, he is just starting business for himself as an instrument maker & I should be glad if you would allow him to make your tasimeters, he will do them well. I am sorry to find you have been treated so badly by the Stereoscopic Company who are making large sums out of the exhibition of your phonograph: & will not sell me one for my lectures, however they have promised to [——][c] exhibit their instrument in Birmingham.

Your carbon telephones ~~must~~ will[d] be the thing of the future. I hope you will have respectable agents. In Ireland no firm ~~is~~ stands higher than Edmundson & Co of Dublin, the chief of this firm is Mr. Wigham[5] whose gas-lighthouses are well known here. Excuse my mentioning this to you, I am in no way interested in any firm, ~~but~~ and[d] can perhaps be of some assistance to you on that account.

If you can send me your likeness to have copied on glass for projection I shall be glad, as an English audience will be interested in seeing a photograph of one who has added so enormously to the practical triumphs of science, as yourself.

I ~~saw~~ met Mr Lockyer[6] in London he told me of his recent interview with you & was full of your work. Unfortunately I missed Col. Gouraud in London & also in Paris, whither I went partly to get all the information I could on the subject of telephones & your other inventions: but your Mr Adams was very good and gave me all details

Again thanking you Believe me My dear Sir Yours vy truly

W. F. Barrett

ALS, NjWOE, DF (*TAEM* 16:130). Letterhead of Royal College of Science for Ireland, Science and Art Department. [a]"Stephen's=green, Dublin," and "187" preprinted. [b]"personally ~~to be~~" interlined above. [c]Canceled. [d]Interlined above.

1. Doc. 1428.

2. Gouraud cabled Edison on this day: "Ship me immediately one each your recent Inventions complete for organized system of scientific special lectures thereon and subsequent permanent exhibition—Barrett [and Josiah Latimer] Clark &c. enlisted." James Adams planned to assist Barrett at the Birmingham lecture, which Gouraud later reported as a "great success." Gouraud to TAE, 24 Sept. and 3 Oct. 1878; Adams to TAE, n.d.; all DF (*TAEM* 16:123, 19:936, 16:170); Adams's letter was dated by Stockton Griffin as "about Oct 1st 78" but must have been written about 23 September.

3. Philip Reiss built the first electromagnetic devices for transmitting and reproducing musical tones at a distance in 1861 and is often credited with the first telephone. Prescott 1884, 9–14; *TAEB* 2:524–25.

4. Barrett's article appeared as "The Microphone" in the October issue of *Good Words and Sunday Magazine,* a general interest and religious monthly. Barrett gave credit to David Hughes for discovering the microphone but acknowledged "the labours of Mr. Edison, who long before had practically applied and it appears independently discovered the principle" of variable resistance underlying the microphone. He also distinguished the Hughes microphone from Edison's telephone in its "entire absence of a diaphragm or of any special apparatus or mechanical contrivances." Barrett 1878c.

5. John Wigham became head of his brother-in-law's hardware business, Joshua Edmundson & Co. He experimented extensively in gas lighting and designed several public and private gasworks. He was particularly noted for his work on gas lighthouses. *DNB,* s.v. "Wigham, John Richardson."

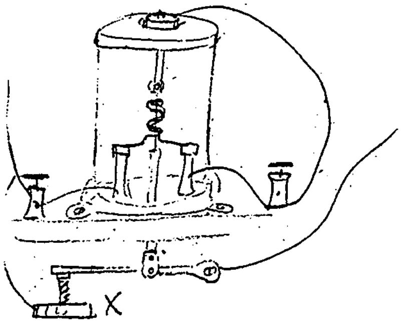
6. J. Norman Lockyer, editor and founder of *Nature,* was a prominent British astronomer whom Edison had met at Rawlins during the solar eclipse expedition. At this time he was connected to the Science and Art Department at the South Kensington Museum. Lockyer had been in the United States to observe the solar eclipse. *DSB,* s.v. "Lockyer, Joseph Norman"; *DNB,* s.v. "Lockyer, Sir (Joseph) Norman"; Meadows 1972; Lockyer 1878; "Total Eclipse of the Sun," *New York Daily Tribune,* 27 July 1878, Cat. 1240, item 798, Batchelor (*TAEM* 94:302).

-1454-

Technical Note: Electric Lighting

[Menlo Park,] Sept 25 1878

Electric Light division[1][a]

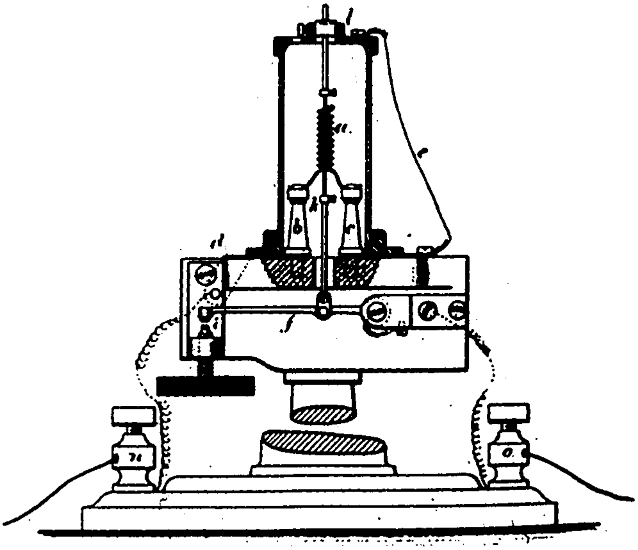


We have now a perfectly regulating light— Spiral wound double to allow for expansion, and the wire in middle same wire as the spiral, only the spiral is flattened to make stronger, and allow more heating surface. As the platina rod expands it closes the cut off points at X, and when the spiral & platina rod are the right size, this is a perfectly automatic cutoff; So that[b] however much current you put on it will regulate before burning up, although the contraction when cold has allowed the points to separate ⅛ inch

T A Edison
J Kruesi
G. E Carman

Chas Batchelor
Martin N. Force
Wm Carman
Stockton Griffin

X, NjWOE, Lab., Vol. 16:40 (*TAEM* 4:518). Written by Batchelor. Copied by William Carman in Cat. 994:139, Lab. (*TAEM* 3:238). [a]Followed by centered horizontal line. [b]Obscured overwritten letters.



Edison's first patented electric lamp design (U.S. Patent 214,636).

1. Batchelor had sketched this lamp the previous day (Vol. 16:35–36, Lab. [*TAEM* 4:514–15]). It is the design shown in Edison's first electric-lamp patent application (U.S. Pat. 214,636), though the patent description and claims relate more generally to the subject of thermostatic regulators and include material from his first electric light caveat (Doc. 1427).

-1455-

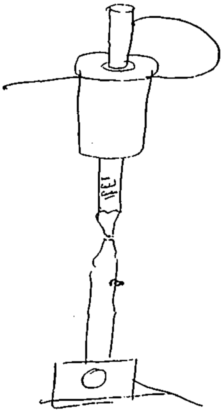
Technical Note: Electric Lighting

[Menlo Park,] Sept 26th 1878

Electric Light Subdivision[a]

Last night we placed around our light another glass tube, & cemented it at bottom, & filled the intervening space with Alum & water, to prevent in a measure the radiation of heat from it. This has the desired object to a great extent but we want something that will do it better

Experimented with incandescence of sticks of Carbon= it will expand and cut off similar to platina or other metals but when brought up to give the same light as platina it melts very easy[1][b]



Edison's arrangement for experimenting with the incandescence of sticks of carbon.

I Put sticks of different thicknesses & lengths ~~of~~ of carbon in place of platina in our light stand, result was not comparable with platina[b]

We want Iridium or or platinum—Iridium—also try Ruthenium[b]

Sticks of finely divided platinum—[c]

T A Edison Chas Batchelor
J Kruesi Martin N. Force
Stockton Griffin Wm Carman

X, NjWOE, Lab., Vol. 16:45, 44 (*TAEM* 4:521, 522). Written by Batchelor. Copied by William Carman in Cat. 994:141, Lab. (*TAEM* 3:239). [a]Underlined twice. [b]Followed by centered horizontal line. [c]"We want Iridium . . . finely divided platinum—" written by Edison.

1. Drawings related to this idea are found in Vol. 16:37–39, 53–54, Lab. (*TAEM* 4:516–17, 531–32).

-1456-

Draft Caveat: Electric Lighting

Menlo Park Sept 27, 1878[1]

Caveat No 2

The object of this invention is to subdivide the Electric Light

The invention consists in various methods of accomplishing this object which I am now experimenting upon

Fig 1

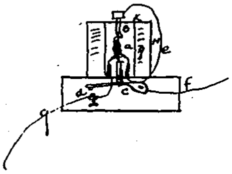


Fig 1 shows a right and left hand platinum spiral a placed in circuit and kept incandescent by the passage of the electric current. this spiral is placed within a glass tube K and this in its turn is placed in another but larger tube H. between the two tubes a nonconductor of radiant heat is placed such as a solution of alum, allthough I hope to be able to dispense with the glass tubes alltogether substituting solid alum tubes in their place.

The employment of a casing around the spiral to prevent the radiation of heat reduces the expense of the light as less electricity is required to give heat when the heat is thus accumulated to help keep the spiral incandescent. C is the regulating lever worked by the expansion of the wire B which is of the same size and passes through the spiral a and is included in the same circuit.

when the spiral is raised to incandescence that portion of the rod B which is small becomes incandescent expans and brings the lever C down on the point d and the current is shunted out of the spiral and rod B. they cool and contract the lever lifts from d and they again are heated.

Fig 2

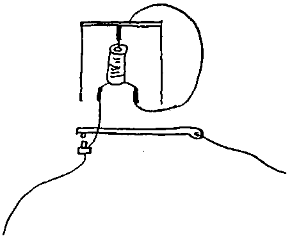
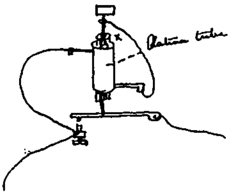


Fig 2 shows the platina coiled around a cylinder of a material which becomes incandescent from heat such as lime chalk etc the proper substance to use I am now experimenting to obtain.

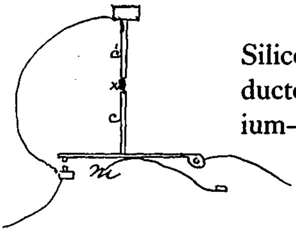
Fig 3[2]



X lime etc

Fig 3 shows instead of a spiral of platina a cylinder of Platinum foil around the lime

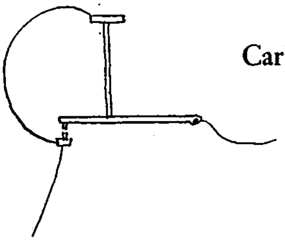
Fig 4



Silicon or boron or any conductor between carbon or Iridium-Platina Poles[3]

Fig 4 shows two platina wires c & c between which a small peice of silicon, Boron, Carbon compressed finely, Platinum Iridium osmium or Ruthenium or other substances which conducts Electricity and becomes incandescent. The expansion of c c′ and the substances used moves the regulating lever m and prevents the temperature raising to the point of destruction.

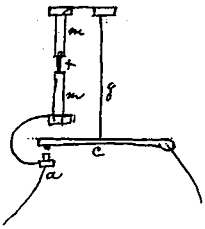
Fig 5



Carbon Stick in vacuum

Fig 5 shows a stick of Carbon acting by its expansion to regulate its temperature the carbon being placed with the other apparatus in a vacuum tube to prevent oxidation

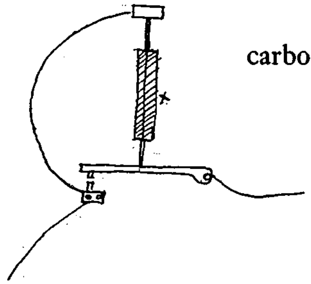
Fig 5



X Platinum black compressed

Fig 5 shows a rod of compressed platina finely divided metal such as Iridium Ruthenium or platinum which becomes incandescent by the passage of the current. placed in the same circuit is a temperature regulating wire g

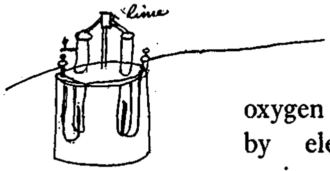
Fig 6



carbon pressed on platina

Fig 6 shows a peice of Platina wire reduced in size for a short distance from the centre and covered with carbon or other finely divided conducting matter

Fig 7[4]



oxygen and Hydrogen envolved by electrolysis and burned against lime—

Fig 7 shews Oxygen and Hydrogen produced by electrolysis and collected and burned on lime cylinders, several hundred being included in the same circuit

Fig 8

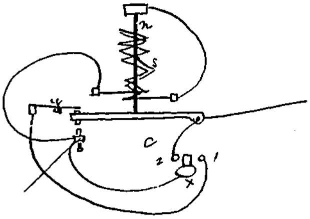


Fig 8 Shews the double platina spiral S with regulating wire passing through it all arranged similar to fig 1 except that a switch X is used to cut the spirals out of circuit when not wanted which N does when the switch lever is in contact with the point and when in contact with 1 it throws on a safety spring .g. which should the spiral S or rod N. fuse and break the circuit allows the lever C to come in contact with it and short circuit the spiral

Fig 9

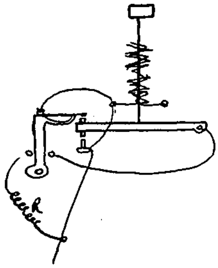
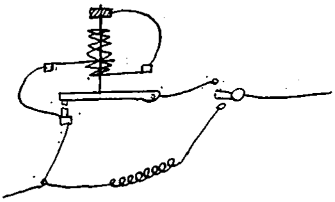


Fig 9 shows a better form the switch lever throwing the safety spring in position when wanted also has a resistance R which is thrown in circuit when the spiral is thrown out thus preserving an even resistance in the circuit

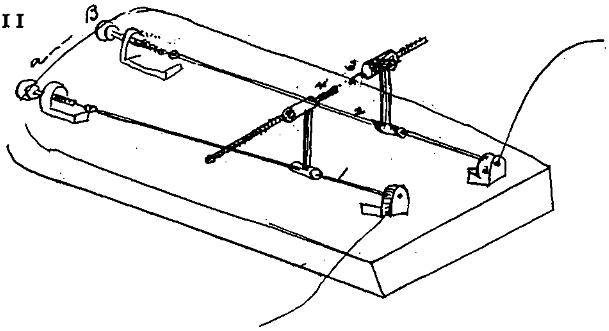
Fig 10



Resistance[5] large wire equal to Spiral

Fig 10 shows this latter device plainly but without safety appliances

Fig 11



Electric Light regulated by torsion

Fig 11 shows an ordinary Carbon lamp. 3 & 4 are the carbon secured to two arms which are in turn fastened to two torsion wires 1 & 2 the amount of torsion being regulated by the screws A & B   the carbons are made to connect and the arc produces a Repulsion

Fig 12

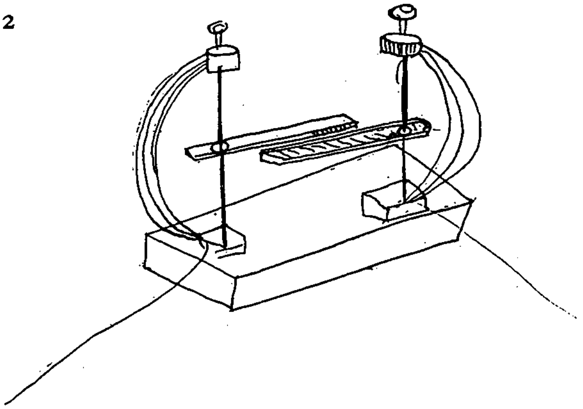
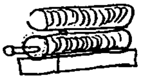


Fig 12 shews a modification of this principle—



Plumbagoed platina cylinders this drawing stricken out of caveat sent

Fig 13[6]

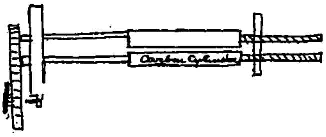
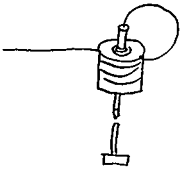


Fig 13 shows two Carbon Cylinders rotated back and forward by a spindle and screw upon it with reversable gear

Fig 14



Iron coated carbon regulate axially

Fig 14 shows the Carbon sticks one coated with Iron and the regulation takes place with an axial magnet.

I claim the various devices herein described

Df (copy), NjWOE, Lab., Cat. 997:64 (*TAEM* 3:384). Written by William Carman. [a]Drawings together on three separate pages.

1. This caveat was apparently begun on 25 September, the date given to the first page of drawings. However, the rest of the drawings and the text are all dated 27 September. Figures 1–3, 7, and 11–14 were included in Edison's Caveat No. 83, one of two electric light caveats filed on 25 October (Edison Caveat 83).

2. Text is "X" and "Platina tube."

3. At X in drawing.

4. Text is "lime."
5. At bottom of drawing.
6. Text is "Carbon Cylinder."

-1457-

Technical Note: Electric Lighting

[Menlo Park,] Sept 27th 1878

Electric Light Subdivision

Length of time it takes to heat over bunsen burner to red heat the following substances:=

	Seconds[a]	Remarks
Limes for OH light[1]	2	
Kaolin	1½	
Tripoli	1	
Sulp. Baryta	3	
Whiting	5	
Fire clay	3	
Silicic Acid	7	
Woodbridge Clay[2]	4	Takes 7 to heat first time
Powd. Marble	5	
Pumice Stone	5½	

Platinum Black	first rate heats before Platinum
Caustic Magnesia	heats white when platina red
&[b] Carb. Magnesia	heats white when platina red
Caustic Magnesia	~~loses~~ contracts[c] less by heat than Carb. Mag.[d]
Oxalate Cerium	Excellent good gets red before platina spoon

Made cylinder of Caustic Magnesia pressed for light and it retains its heat but the loose unpressed does it much better[3]

Struck the idea that probably coating the platina spiral with a saturated solution would be what we want.

Solution Alum	very good bright & leaves good deposit on spiral
Sulphat Magnesia—	More brilliant light leaves little deposit.[d]
Tungstate Soda	no good.[d]
Chlorate Potash	no good.[d]
Chloride Sodium	very good, small deposit[d]
Acetate Lead	no good melts platina[e]
Sulphate Thallium	N Good
Carb Yittera[4]	Fair something like Oxalate Cerium

Oxide Zircon.	a not very good might try it further[f]
Niobic Acid	fair—redish
Wolfram	not good—
Caesium Alum	not quite so good as Magnesia
Osmium—	N.G.
Strontium	N.G.
Protochloride of Tin	N.G.
Lactate Zinc—	fair
Caustic Strontia	N.G.
Bromide of Cadmium	N.G.
Carb Lithia	NG
Oxide Glucinium[5]	acts like Magnesia
Ox-Beryllium—	not good
Acetate Alumina—	NG

T A Edison
J Kruesi
Wm Carman

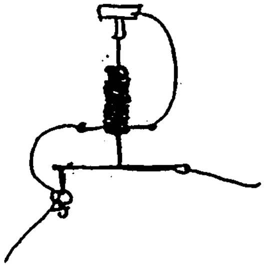
Chas Batchelor
Martin N. Force
Stockton L Griffin

X, NjWOE, Lab., Vol. 16:49, 47–48 (*TAEM* 4:527, 525–26). Document multiply signed and dated. William Carman copied this in Cat. 994:145–47, Lab. (*TAEM* 3:242–43). [a]Numerals in this column placed between dashes; dashes not transcribed. [b]Interlined between this and previous entry to indicate equivalence. [c]Interlined above. [d]Followed by centered horizontal line. [e]Followed by centered horizontal line; written by Batchelor to this point, rest of document written by Edison. [f]"Try it further" underlined twice.

1. An oxyhydrogen or Drummond light uses a flame generated by the combustion of hydrogen and oxygen gases to heat a lime cylinder to incandescence. Atkinson 1890, 581.

2. Woodbridge, N.J., located a few miles east of Menlo Park, had extensive clay deposits.

3. The same day, Edison drew a lamp design in which a spiral was "filled with loose magnesia or other substance." NS-78-005, Lab. (*TAEM* 7:814).



Edison's design of a spiral lamp burner to be filled with loose material.

4. Yttria.

5. Glucinium, also called glucinum, was later identified as beryllium.

-1458-

[Menlo Park,] September 27, 1878

Technical Note: Electric Lighting and Telephony

Electric Light

Make alloys of Silicon with Aluminum Zinc & platinum for incandescence ~~by~~[a]. I think that a little aluminum or platinum will get rid of the brittleness.

Between the two cells which I have around the incandescent spiral put finely divided ~~alum~~ ammonia-alum. This will melt & the water will evaporate. This will keep ~~out~~ heat from radiating.

Try chromium, between platina points.

Make some Sulphide Silver by ~~fusing~~ melting (Hydrosulphuric Acid Chl Ag) Sulphide Silver—its malable & soft may make a fluf for telephone—

Try powdered Antimony & Bismuth (easily powdered) for telephone buttons—

also amorphous Antimony (to make, X. p 408–9. Big Bloxam[1]

~~m~~note[b] Coat thin ferro plate with 1/16 inch of melted resin—Damar, Shellac etc to crackle—make a hard rolled tin diaphragm

Try Tungsten Electric L[c] = to make (Big Blox. p 421.

Molybdenum —— (")[2]

Make a lampwick of pressed platinum black and asbestos on outside, also try a spiral

Electric[b] Light, Try palladium

T. A. Edison	Chas Batchelor
J Kruesi	Chas. P. Edison
G E Carman	M N Force
W[illiam] C[arman]	Stockton L Griffin

X, NjWOE, Lab., Vol. 16:56, 55 (*TAEM* 4:534, 533). Document multiply signed and dated. Copied by William Carman in Cat. 994:186–87, Lab. (*TAEM* 3:263). [a]Interlined above. [b]Preceeded by horizontal line at left of page. [c]"Electric L" interlined above.

[1] At 700 pages, Bloxam 1873 was considerably larger than the same author's other chemical manuals, and slightly more so than its earlier editions. It gave instructions for obtaining by deposition a form of antimony which "has a brilliant metallic appearance, but is amorphous, and not crystalline, like the ordinary metal" (pp. 408–9).

[2] Bloxam 1873 (p. 421) also gave directions for reducing tungstic acid with white-hot charcoal to "an iron-grey infusible metal," and for similarly reducing molybdic acid to a "white metal, fusible with difficulty."

-1459-

From Grosvenor Lowrey

New York, Sept 28th 1878[a]

My Dear Edison:

I have not received a notification from Mr Edson of Mondays meeting. My impression is that they prefer not to talk with me in advance of our coming together. I am quite convinced that it will be most for your interest and mine, in dealing with them, that I should act with and for you, entirely; and I shall therefore decline to be interested, and will approach the whole matter from your side of the business.

I will be at my office at ten o'clock on Monday morning.[1] I think you should come here before seeing either of them,[2] that we may confer, and that I may inform myself, a little more fully, as to the terms which were proposed. You can then call upon Mr Edson and return with him to my office. Yours Very truly

G. P. Lowrey

LS, NjWOE, DF (*TAEM* 18:10). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted.

1. On 30 September, Lowrey telegraphed Edison, "I must have misunderstood you as to the day of meeting here Is it tomorrow I have some good news for you." They apparently did meet with Tracy Edson later that day (see Docs. 1465 and 1467). Preparatory to the proposed meeting with Edson, Lowrey had arranged to meet with Edison on 24 September, but on that day he was telegraphed by Stockton Griffin, "Edison was up all night went to bed at ten oclock think he forgot engagement with you." Two days later, Lowrey again sought a meeting with Edison who telegraphed in reply, "If I come to New York I lose the day—time valuable on light please come out." Francis Jordan to TAE, 24 Sept. 1878; Lowrey to TAE, 24, 26, and 30 Sept. 1878; Griffin to Mary Edison, 24 Sept. 1878; Griffin to Lowrey, 24 Sept. 1878; TAE to Lowrey, 26 Sept. 1878; all DF (*TAEM* 18:4–6, 8–9, 11).

2. It is unclear if the other party was James Banker, who had joined with Edson in his efforts to gain an interest in Edison's work on electric lighting; Hamilton Twombly, who was apparently negotiating separately; or the Mr. Billings mentioned in Lowrey's letters to Edison of 1 and 2 October (Docs. 1465 and 1467).

-1460-

Draft to the Editor of the Chemical News

Menlo Park, N.J., Sept 29 1878[1a]

To the Editor of ~~Mech~~ Chemical News

~~Notwithstanding Mr Houston assertions regarding the telephone relay.~~

~~Mr Houston seems to be~~

In your issue of Sept 13, 1878[2] I notice a ~~reply~~ counterstatement from E G Houston of Philadelphia regarding my assertion that the ~~R~~Telephone relay which he has brought out and which was devised by me over a year ago. ~~He slightly errs when he states that I did not use the arrangement for transmitting speaking telephone currents~~. He[b] says=

"Now it would[c] appear from a description of this instrument in the Telegraphic Journal of July 1st 1877 that Mr Edison calls his invention a Pressure Relay and states that it is intended to be used in connection with his speaking telegraph= So far as I can learn this speaking telegraph is not an articulating telephone but a species of harmonic telegraph in which vibratory ~~impulses~~ pulses of electricity are employed in a manner somewhat similar to the system of Gray. Nowhere in this article or indeed elsewhere that I can find does Mr Edison claim that his invention can be applied to relaying of rapidly varying currents of the articulating telephone."

~~Now to show~~ I quote from the article in the Journal of July 1 1877 which he mentions

*For instance if a weak current circulates upon the line in which the relay magnet is inserted the attraction for the armature will be small. Consequently a weak current will circulate within the second circuit & one the contrary if the current in the first circuit be strong the pressure upon the plumbago discs will be increased & in proportion will the current in the second circuit be increased no adjustment is ever required. It is probably the only device yet invented which will allow of the translation of signals of Variable strengths[d] from one circuit into another by the use of batteries in the ordinary manner The apparatus was designed by Mr. Edison for repeating acoustical vibrations[e] of variable strengths[f] in his speaking Telegr"

This apparatus is used now and was used ~~then~~ at the date named[g] to do exactly what the article says it was intended for. ~~If a &~~ & thousands of persons have seen it in operation in 1877[h] The statement that a "Speaking Telegraph" is not an "articulating Telegraph" is a pretty small hole to crawl out of.

~~T A Edison~~

Change[b] of form and name ~~as with Hughes and Houston~~ seems to be an easy[i] and favorite method, nowadays of making startling discoveries.

ADf, NjWOE, DF (*TAEM* 17:177). Letterhead of T. A. Edison.

[a]"Menlo Park, N.J.," and "187" preprinted. [b]Obscured overwritten letters. [c]Interlined above. [d]Underlined twice. [e]"acoustical vibrations" underlined twice. [f]"variable strengths" underlined twice. [g]"at the date named" interlined above. [h]"& thousands . . . 1877" interlined above. [i]"an easy" interlined above. [j]This sentence was written around Edison's canceled signature.

1. Edison's letter appeared in the 18 October issue with minor alterations (38:198).

2. Houston's letter, dated 22 August, appeared on p. 138.

-1461-

To George Gouraud

Menlo Park, N.J., Sept 29 1878[1a]

Gouraud,

Have arranged put you and ~~other~~ strong[b] parties here in light in England.[2] Continent by courtesy goes to Puskas.[3] Tell Adams discovered new receiver no magnet.[4]

Edison

ALS (telegram), NjWOE, DF (*TAEM* 16:163). Letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted. [b]Interlined above.

1. Edison had indicated above the text of the telegram that Stockton Griffin should send this to George Ward of the Direct United States Cable Co., which he did the same day. At the bottom, Edison wrote a note for Ward: "Will come in and see you Monday if possible or if not some day next week, am ever so much obliged to you for the facilities you offered." It is not known what offer Ward had made.

2. In fact, Edison had not yet made arrangements regarding foreign rights to his electric light. The parties apparently involved are indicated in Docs. 1490 and 1497.

3. Gouraud cabled back on 1 October: "Then make Continent to Puskas and myself jointly. Expedite shipment new receiver. Forward promptly all improvements." DF (*TAEM* 16:172).

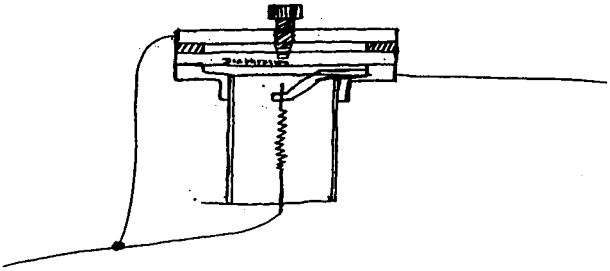
4. It is unclear if Edison is referring to the new electromotograph receiver or to one of the designs discussed in Doc. 1470 n. 1.

-1462-

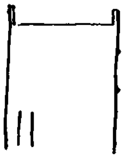
Technical Note: Electric Lighting

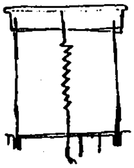
[Menlo Park,] Sept 30th 1878

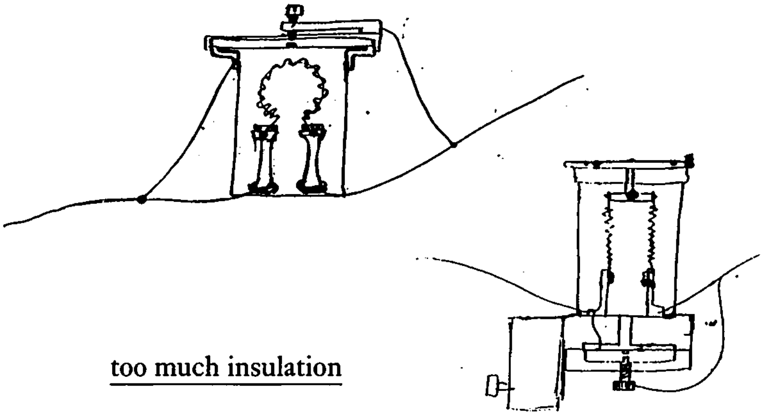
Electric Light Subdivision.[1]



Edison's plan of cutting off by Expansion of air working a diaphragm to close point.







too much insulation

TAE
J Kruesi

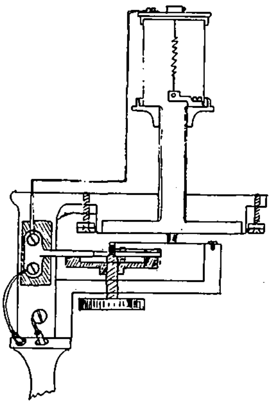
Chas Batchelor
M N Force
Stockton L Griffin

X, NjWOE, Lab., Vol. 16:59 (*TAEM* 4:538). Written by Batchelor; copied by William Carman in Cat. 994:151, Lab. (*TAEM* 3:245).

1. Text is "Diaphragm." This design was the subject of Edison's second electric-lamp patent application, which he executed on 14 November and which issued as U.S. Patent 214,637 on 22 April 1879. He described it as

> causing the heat generated by the incandescent conductor to expand the air or fluid in the containing-chamber as its temperature rises, the pressure thus created serving to move outwardly a yielding material—such as a diaphragm—which, in its turn, serves to control the passage of the electric current through the incandescent body by means of contact points or circuit regulators, and thus the temperature of the incandescent conductor will be regulated automatically.

Batchelor altered this design on 30 September, and he modified it again the following day. This style of regulator was also included in Edison's 3 October draft caveat (Doc. 1472 [fig. 1]). On 7 October, Batchelor drew another variation in which the regulation was produced by the expansion of a column of air in the base of the lamp. Vol. 16:64, 66, 110, Lab. (*TAEM* 4:543–44, 570).



Charles Batchelor's drawing of a "light regulated by expansion of a column of air heated."

-1463-

Technical Note: Electric Lighting

[Menlo Park,] Sept 30 1878

Electric Light
Effect when held in flame by platina wire of—
Chromium=

When[a] held in li~~t~~ght gets red but not quite so much as platina   it however keeps its redness 3 times as long as the platina. When held in powder[b] small spiral heated by 4 cells carbon no good[c]

Oxalate of Cerium   Burnt[d]

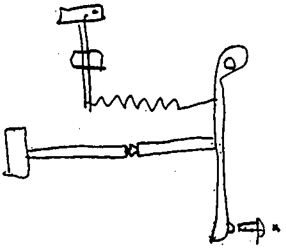
I[a] find that when I put small pieces of this on the edge of the bunsen burner they stay there and give off a very brilliant light[e] and I see no diminishing of intensity in two hours. I had been watching it   I find however it gets some of its brilliancy by being supplied with oxygen as if I shut off the air in the bottom holes in burner   the flame is brighter but the cerium goes out almost entirely.[c]

Chromium:[d]

With[a] 40 cells battery a small piece of chromium gives a light similar to Silicon & (soft)[f]

Chromic Acid[d]

In flame=burns with very bright light and residue swells out and keeps hot but not longer than platina   however in fact it gets hot & loses its heat both quicker than P   Chromic acid burnt in flame   Residue is not a conductor of Electricity



Cerium=

Chromium=

Boron[g]= from Borax in arc of carbon light good conductor= metallic fracture= brittle= form of bent cake—[f]

T A Edison   Chas Batchelor
J Kruesi   M N Force
Stockton L Griffin

X, NjWOE, Lab., Vol. 16:63, 62, 61 (*TAEM* 4:542, 541, 540). Written by Batchelor; document multiply signed and dated. Copied by William Carman in Cat. 994:149, Lab. (*TAEM* 3:244). [a]Paragraph demarcated by wavy bracket on left. [b]Interlined above. [c]Followed by two centered wavy lines. [d]Multiple horizontal lines above and below heading. [e]"light" underlined twice. [f]Followed by centered wavy line. [g]Preceded by centered wavy line.

-6- October 1878

At the beginning of October, negotiations intensified between Grosvenor Lowrey and potential investors in Edison's lighting experiments. They soon reached an agreement and on 16 October the Edison Electric Light Company was incorporated with a capital stock of $300,000. Most of the investors in the new company were affiliated with Western Union or with Drexel, Morgan & Company.[1] Lowrey was also negotiating with Drexel Morgan regarding foreign rights to Edison's electric light, though these negotiations were complicated by Edison's relations with Theodore Puskas and George Gouraud.

As news of Edison's electric light experiments spread, it produced a panic that caused the price of gas company shares to drop in New York and London. The London publishers Sampson Low, Marston & Company also approached Edison about producing a pamphlet on his electric light. And at the end of the month, the Rothschild family expressed an interest in foreign rights through their American agent, August Belmont.[2]

Assured of ample funds for his lighting experiments, Edison purchased an eighty-horsepower steam engine and began construction of a substantial brick machine shop and engine house and a two-story brick office.[3] These new shop facilities would allow him to build dynamos as well as lamps; his machinists were already working on a turning-fork generator based on his 1876 motor design. Increasingly concerned that existing generators might prove unsuitable for his system, he began to investigate their design and to study the problems involved in regulating dynamos and line loads. To aid in this research he acquired one of Edward Weston's generators and a second, larger machine from William Wallace.

Edison continued his experiments with lamps, and on 25 October he filed two caveats incorporating designs from one of his September draft caveats and from three earlier October drafts.[4] Besides regulator designs, his lamp experiments included investigations of alternative shapes and materials for his burners and the use of protective coatings on them. Edison considered his approach distinct from those of other inventors, and, in late October, he became infuriated when the directors of the Light Company expressed concern over William Sawyer's and Albon Man's claim that their lamp patents gave them priority over his designs.[5]

While most of the laboratory staff focused on the lamp research, Charley Edison continued to experiment on the electromotograph telephone receiver, with occasional assistance from Charles Batchelor. In early October, Charley designed several wall brackets for these telephones, including some that took advantage of the electromotograph's loud-speaking quality by using a horn instead of listening tubes. He also developed a standard electromotograph button consisting of chalk, acetate mercury, and a saturated solution of caustic soda and began extensive experiments to arrive at the best amounts of each to use.[6] Edison hoped that this receiver would enable him to get around Bell's patent, which became increasingly important when the Bell Company in London secured an injunction against James Adams and the manufacturers making Edison telephones there.[7]

Another project briefly occupied Edison's attention during the second week of October, when he and Batchelor turned to the design of a new dictating machine. Although sales of exhibition machines rose in October, the Edison Speaking Phonograph Company was concerned that the demand for these "cannot be expected to last many months longer,"[8] and urged their replacement by a standard commercial machine. One of the new dictating phonographs was apparently built and Edison applied for a patent on the design in March 1879, but he made no effort to develop it into a commercial instrument.

Frustrated by a similar lack of progress in developing a commercial toy phonograph, Charles Harris dissolved his partnership with Oliver Russell in mid-October. Hilborne Roosevelt agreed to replace him as a party to the toy phonograph contract with Edison.

Other matters occasionally drew Edison's attention away from the light. In early October, Howard Schuyler, a San Francisco civil engineer, addressed an electric-pen circular to western mining companies requesting that they send Edison information about temperatures and ventilation in their mines so that he could develop a method of reducing temperature and humidity. However, nothing seems to have come of this.

Older concerns demanded Edison's attention as well. George Bliss continued to press him for assistance in combatting infringers of the electric pen. E. Baker Welch, who had supported Edison's multiple telegraph experiments in 1868–69, renewed his claims to the quadruplex, and Edison asked Lowrey to deal with this in his capacity as Western Union attorney. Finally, Edison returned briefly to the microphone controversy by presenting his case in a long letter to William Barrett, physics professor at the Royal Dublin School of Science, who had begun to champion his inventions in Britain.

During October, Edison hired several new workmen. John Ott, who had been working for the toy phonograph investors at Menlo Park, now joined Edison's staff as a full-time machinist. Other new machinists included Charles Dean, who had worked in Edison's Newark shops, Rudolph Hense, and Charles Moffat.[9] H. A. (Alex) Campbell began as a carpenter working on the new buildings and then did other carpentry work around the laboratory.[10] F. Cornish was a handyman, as was Joseph Freeman, who worked briefly at the beginning of October.[11] It may have been at this time that Edison considered setting up a boarding house for his staff. Sarah Jordan, one of Mary Edison's relatives (she was Mary's father's stepdaughter from his first marriage), who was visiting Menlo Park in October, presumably to assist the family during Mary's pregnancy, was running the boarding house on Christie Street by December.[12]

Mary gave birth to their second son, William, on Saturday, 26 October. Just prior to the birth doctors were called in to attend not only to Mary, who was having a difficult time, but also Edison, who had developed a case of facial neuralgia after having a severe cold earlier in the week.

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1. Doc. 1494 n. 4.
2. See Doc. 1566.
3. Doc. 1500 nn. 1–2.
4. See Docs. 1456, 1472, 1485, and 1503.

5. See Doc. 1542.

6. Doc. 1440 n. 7.

7. Doc. 1497 n. 2.

8. Doc. 1484.

9. On Dean see time sheets, DF (*TAEM* 17:735, 754); Cat. 30,108, Cat. 1210:156, Cat. 30,107, Cat. 30,105, Cat. 1218:122, PN-72-08-16, all Accts. (*TAEM* 20:188, 694; 21:2, 29, 243; 22:219); for Moffat and Hense see Doc. 1496 nn. 2–3.

10. Jehl 1937–41, 22–23, 373; time sheets, DF (*TAEM* 17:752, 756).

11. Time sheets, DF (*TAEM* 17:753, 763, 772, 728).

12. Edison asked her to come to Menlo Park in early October, possibly because of Mary's advanced pregnancy. On 20 December, he opened an account book entry for her, presumably related to the boarding house. TAE to Sarah Jordan, 7 Oct. 1878 and Jordan to TAE, 11 Oct. 1878, both DF (*TAEM* 16:191, 225); Ledger #3:311, Accts. (*TAEM* 87:140); Stillwell family genealogy sent by Mrs. J. Ellsworth Doughty, 9 Mar. 1956, EBC; see also Braden 1983 and Jehl 1937–41, chap. 4.

-1464-

Draft to George Bliss

Menlo Park, N.J., Oct 1st 1878[a]

Dear Sir

Your favor of the 25th ult relative to the Stock Co was duly rec'd—[1] ~~My The~~ [—][b] My[c] idea was to have a Co formed to take my small inventions, like the E pen and auriphone[d] &c, and find a market for them. I ~~expect to turn out other inventions of this~~ kind ~~and want to place them as soon as~~ ~~desire that~~ should be very much pleased to have a Co should be formed that would market ~~my~~ these small inventions of mine[e] when[f] perfected I have enough of the larger ones to keep me busy. Of course the Co must be a responsible one

ADf, NjWOE, DF (*TAEM* 18:339). Letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted. [b]"~~The~~ [—]" interlined above. [c]"My" interlined below. [d]Obscured overwritten letters. [e]"~~Desire that~~ a Co should be formed" interlined above; "should be very much pleased to have" interlined above that; "that would market ~~my~~ small inventions of mine" interlined below that; obscured overwritten letters in "mine." [f]Interlined above.

1. On 25 September, Bliss had sent Edison a circular for a proposed "Edison Merchandising Co.," the basis of which would be the electric pen business. Bliss had asked Edison "to become one of the incorporators and a stock holder," saying "I should like to have you a prominent official in the Co. or at any rate want the benefit [of] your name and influence." In urging Edison's participation, Bliss noted that the electric pen had been Edison's "first venture outside of the telegraphic field and on this account it is desirable for you that [it] be a permanent success." He also thought Edison would be "disposed out of personal friendship to me to help this matter along." No company was formed. DF (*TAEM* 18:329, 332).

-1465-

From Grosvenor Lowrey

New York, Oct 1st 1878[1a]

My dear Edison

I agree with you entirely as to Mr Twombly; & if he had not been at my office on my arrival, I should have been at his within a half-hour to lay my plan before him— As it was he agrees with me in everything except giving the Gas people an option— I explained that, I resorted to that merely as one means of putting some money in your pocket without taking it from our own subscribers, & asked if he would be willing to add that to the amount to be paid in so as to get for you the clear sum of $100,000 all cost of machinery experimenting &c to be paid out of the Company's treasury— He answered very frankly & promptly that he would I believe now that he and I have a fair prospect working together to get you that sum; to provide an ample working capital, & to satisfy Mr Banker,[2] & Edson ~~before~~ as to[b] these special points. I cannot now take the time to set them forth, but if you can receive a visit on Thursday or Friday from Mr Billings[3] & two or three others I will have everything ready & will talk it all over— Please let me know what day to go over—

Give your whole mind to the light— I will see that not only do you get what you ought to have but that every reasonable expectation of those who have "spoken to you" is satisfied— I want Western Union people to have the best chance at this because both you & I know who we are dealing with; & my night reflection had determined me to call on Mr Twombly this morning— We are therefore quite in accord in this respect; & I welcome Mr Twombly's co-operation, for I believe he will do as he said, he would (i.e) try to get you a suitable & worthy compensation instead of trying as is not unnaturally the usual custom, to get the lowest price which your modesty or your necessities might make possible—

I enclose a copy of a letter just written by me to him in response to a request for a copy of a project for a company &c which I showed him—

By the way, Mr Billings says that twenty five cents per light would give you a income exceeding Mr Stewarts—[4] I told him & Twombly that some fixed royalty would be a condition because you were thus assured of something definite, but the amount might properly be the subject of negotiation upon the basis of your getting $100,000 & of their getting their money back before the payment of any dividend—

You will note what I have said about their having one year before paying the second fifty thousand—

Keep your expectations moderate, notwithstanding this suggestion of large figures— Perhaps we may not get it all Truly

G. P. Lowrey

You will probably have to cure Edson's & Banker's disappointment by giving them (confidentially) in addition to what they subscribe for, $5000 of your free stock.

ENCLOSURE[c]

New York, Oct 1st 1878[a]

My Dear Mr Twombly:

I have been detained so long that I cannot now revise as I would wish, the memorandum which I read to you this morning and I therefore submit in this form the substantial part of a project for a company to own and use or license the use of Edisons electric light

First. I understand that all serious difficulties have been overcome and that there is every reason to believe that he has discovered the means of giving an electrical light suitable for every use at a vastly reduced cost as compared with the cost of gas.

He is willing to sell one half of this invention for $150 000, payable, say $50 000 upon the execution of a contract between him and a company to be formed; $50 000 at the end of say, one year provided the company then desires to go on, his patents to be all reassigned and his contracts cancelled in case they do not wish to go on; and $50 000 or so much as may be necessary to be disbursed by the company in experiments machinery &c requisite for completely perfecting all things connected with making the light.

Second. In order to accomplish the essential features of it, Mr Edison desires and I suggest as a feasible method that we organize a stock company with a capital stock of $300,000, $150 000 of which to be issued as full paid stock and reserved by Mr Edison; $150 000 to be subscribed for by parties acceptable to yourself and to me

Third. The board of directors to be chosen entirely by the subscribers to the cash subscription subject however to objections by you or by myself. The object of this reservation being as was expressed between us to day, to protect Mr Edison from the chance that persons interested in other means of lighting might seek the control of such a company with a view to suppress rather than to develope this invention

Fourth= After the Company shall be in operation the first profits to be devoted to the repayment to cash subscribers of the amount paid in— After such repayment Mr Edison to have a fixed royalty per annum, per light, the amount of which I cannot even intelligently suggest now, although as you are aware Mr Edson and Mr Banker had in their[d] proposed contract with him fixed it at 25¢ per light per annum, and after the payment of that royalty the profits to be divided upon the stock as in every other case. (margin A.)[e]

(A) I assume that there can be no objection to a royalty fixed at a proper amount and payable to the inventor before making dividends, since, at that time, the subscribing stockholders will be the owners of one half these valuable inventions free of all cost. The patents to be conveyed by Mr. Edison are to cover all inventions by him, now made or to be made within five years, for the United States and Canada.

I think on the whole, I will wait until I can see you tomorrow and have the benefit of your reflection upon these points before reducing the matter to the form of a contract or prospectus. This may save me some little trouble, and be done beneficially.

I have said nothing about the matter which we so fully discussed—(ie) the way in which these stock subscriptions should be distributed. You understand that in this matter I am acting for Mr Edison, charged with the duty of protecting his interest solely. I should prefer to have this thing taken up among our friends because we then know with whom we are dealing. But there are some reasons, as I expressed to you to day, why I think one third of the cash subscription should be distributed among good men like Mr David Dows[5] and Mr. A. H. Barney,[6] and others having no connection of any sort with Gas Companies; that some (perhaps a third, but certainly far from a controlling interest) should go to parties who are distinctively in the Gas interest or other lighting interests; and the remainder (and I should hope the larger portion) I should like to see taken by Western Union people. Truly Yours

(s[igne]d) G. P. Lowrey OB[7]

ALS, NjWOE, DF (*TAEM* 18:16). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted. [b]"as to" interlined above. [c]Enclosure is L (copy). [d]Obscured overwritten letters. [e]Following paragraph written in margin.

1. At three o'clock in the afternoon of 1 October, Twombly telegraphed Edison to arrange a meeting and was told by Batchelor that "Edison has just gone to bed." Batchelor then suggested that Twombly and Edison arrange to speak by telephone, but Twombly urged that Edison come in and spend the night in New York. Although Edison telegraphed later that afternoon that he would come into New York at seven-twenty, Twombly arranged instead to go out to Menlo Park. He was apparently to be joined by Chauncey Depew, the general counsel for William Vanderbilt's New York Central Railroad. Telegrams between Twombly and TAE, Batchelor and Twombly, and Depew and TAE, all 1 Oct. 1878, all DF (*TAEM* 18:13–15); *DNB,* s.v. "Depew, Chauncey Mitchell."

2. James Banker had been a Western Union director and member of the company's executive committee for many years. Western Union 1873–78.

3. Unidentified.

4. Probably A. T. Stewart.

5. David Dows was a commission merchant located at 20 South St. Wilson 1879, 390; *Wilson's Business Directory of New York City* 1879, 496.

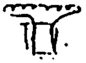
6. Ashbel Barney was president of the U.S. Express Co. Wilson 1879, 71, and "City Register," 39.

7. Unidentified.

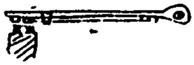
–1466–

Equipment Specification: Electric Lighting

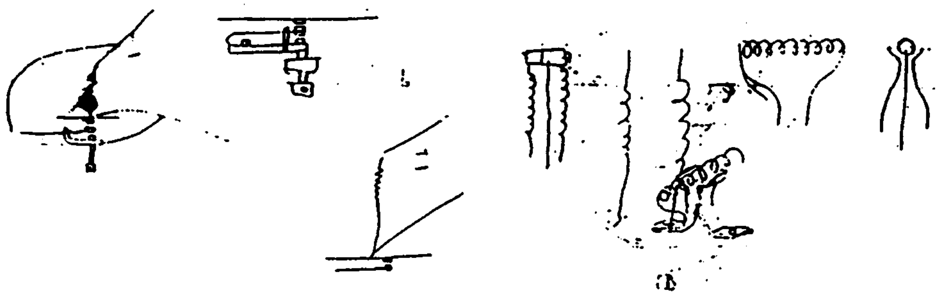
Menlo Park, N.J., Oct 1st 1878[a]

New Model= 

Spiral so moulded right in plaster paris.[1b]

Contact point made one solid and small spring with spark point[2c] 

Diaphragm model[3]



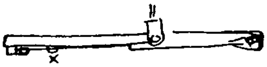
TAE
J Kruesi

Chas Batchelor
M N Force
Stockton L Griffin

D, NjWOE, Lab., Vol. 16:75 (*TAEM* 4:548). Written by Batchelor; letterhead of T. A. Edison. Copied by William Carman into Cat. 994:159, Lab. (*TAEM* 3:249). [a]"Menlo Park, N.J." and "187" preprinted. [b]Followed by centered horizontal line. [c]Drawing followed by centered horizontal line.

1. Edison's drawing of this arrangement for the burner is in Vol. 16:68, Lab. (*TAEM* 4:545).

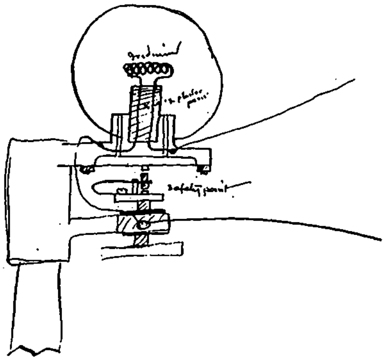
2. Edison and Batchelor drew alternative lever arrangements on 1 October and, on 3 October, Batchelor prepared another drawing with instructions for machinist George Jackson to alter the arrangement of the spring on the lever: "The little holdback for this spring at X is too far away from the points You must put it right close up to them only 1/16 away from them." Vol. 16:69, 75½, 79, 97, Lab. (*TAEM* 4:545, 549, 551, 561); see also Batchelor's undated instructions to Kruesi regarding the spring arrangement in Vol. 16:410–11, Lab. (*TAEM* 4:847).



Charles Batchelor's lamp regulator drawing of 3 October.

3. The same day, Edison drew a lamp with an iridium burner molded into plaster of paris and regulated by this diaphram arrangement. NS-78-005, Lab. (*TAEM* 7:815).

Edison's drawing of an iridium burner lamp.



-1467-

From Grosvenor Lowrey

New York, Octr 2nd 1878[a]

My Dear Edison:

Mr Twombly met me on my arrival in New York this morning and took me to Mr Vanderbilts house where I spent about an hour and a half. They seemed a good deal fortified by a remark of yours that I had put the figures up much higher than anything you had anticipated. I told them that proved how important it was that you should have a friend to advise you. We separated after a good deal of talk with an engagement to meet again at Mr Vanderbilts house this evening.

In the meantime Mr Billings has been here, and I have telegraphed to know when you could show the light. He says the proposition which I made in the letter to Mr Twombly, (a copy of which I enclosed to you yesterday,) is reasonable, if the light is what I described it to be, and I have not attempted to do more than describe what my eyes rested upon.

And, now, Mr Banker and Mr Edson have been here. Mr Edson declares himself ready and willing to take up the proposition as made to Mr Twombly and go right on with it. I repudiated entirely his interpretation of what had taken place as constituting a contract, and said to him that he knew perfectly well that nothing had been arrived at, and fixed, in such a way as to make it improper for either party to with-draw. He himself would have felt at perfect liberty to have said to you that day, after thinking about the electric light, "I don't think there is much in it, and I won't put any money in"; and you know that you would not have felt that you had any right to complain of him for that.

I intend to unite all these competing interests into one concern; and Mr Edson and Mr Banker have declared that they will be satisfied if they have a chance to subscribe, for $10,000 each, in the $150,000 subscription, if you will make to them some private concession out of your stock. I would suggest that you give them $5000 each. I believe then that with this strong combination they will make more money than they would if they had been organized in the way they proposed with all the rest of the world outside fighting in the courts and elsewhere. They have just left me, and Mr Edson seemed, on the whole, to be contented. I said "you must smile upon me when you meet me, and not think I have wronged you."

I do not see how you can do otherwise than come to New York if telegraphed for by Twombly; nevertheless I think in such matters two men may sometimes thwart each other, if they act separately, and you should be as reticent as you can, putting the matter upon me, or requiring, before saying anything, that I should be present.

Mr Twombly and I have discussed various ways of paying the $100,000; and probably this evening there will a proposition made that you shall receive $25 000 cash; that they spend $25 000 for the experiments; that at the end of the year, if the experiments are successful, you shall have $25 000 more, and that then you shall receive a yearly sum payable per month or per week, as you see fit instead of the round sum of $50,000 more, down. I think they will agree to this; and I suppose, from what I have heard you say about such matters, you would prefer the money payable in that way, from time to time.

I then propose that the first profits shall be used to restore these gentlemens money; that after that you shall have a royalty, the amount of which we must get out with a little more soundness of judgment than before, for they all laugh at 25¢ royalty, Mr Vanderbilt saying this morning that it would produce to you Mr Astors fortune every year, and he did not suppose you wanted so much— There will be, therefore, two yearly sums to be provided for; one yearly sum in lieu of a cash payment of $50,000, and which may be made for your life or for the life of the patent, depending on what the sum is, and the other to be a yearly sum in lieu of royalty.

Mr Vanderbilt thought that would be more satisfactory to you than a royalty, because it is possible to cheat or be deceived in respect to royalties, and very difficult to keep the accounts.

I repeat to you that I see no difficulty in causing all these present competitors to unite to feel pleased with you and with me and with each other and give you what I demand.

And don't you tell people any more that I demand too much for you. I mean to be perfectly just; and would not willingly demand too much for you any more than I would willingly demand less than I think ought to be paid to you. Yrs

G P. Lowrey

LS, NjWOE, DF (*TAEM* 18:25). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted.

-1468-

From Theodore Puskas

Paris, le 2nd Octob. 1878[a]

My dear Edison,

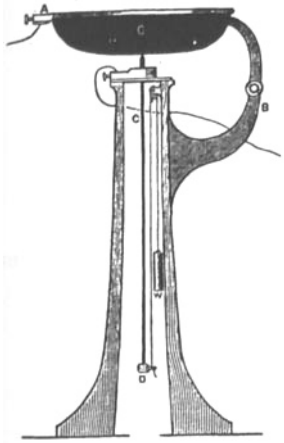
As I cabled you some days ago I made arrangements that one thousand dollars should be paid ~~in~~ to[b] my ~~name~~ credit[b] to Serrell.—

I will cable you in a few days to let me know whether the money is paid by the tenth[1]—otherwise I will send it by cable from here. I will send also the surplus if more is needed.— I made it one thousand because the first lot for which I paid in New York was twelve hundred fifty—including Spain at 300,—but now according to the new law in Spain the inventor has 2 years time to apply for a patent.— If you let me have a share in the additional countries too—for which we have the telephone & phono patent,—please tell Serrell to cable me the amount and I will forward it at once with great pleasure.— If your invention is practical and only a little superior to what they have got now in electric light—there is lots of money in it; and patents ought to be taken out in every known country.

Do you know [-][c] Werderman's patent.—(I think he got his patent ~~i~~for England in June last.)—[2] They say he found also the indefinit subdivision of light.— It is rumored here that the London Gas Companys paid him about a fortnight ago for his English patent one million dollars.

There is a very strong Company here in france for Electric light.— I had already a talk with the managers—they are very anxious to hear more about your light. We will get from them all the money we want. Yours very truly

Theo. Puskas



The mechanism of Richard Werdermann's contact arc lamp, with its carbon block and rod.

ALS, NjWOE, DF (*TAEM* 16:174). Letterhead of Theodore Puskas. [a]"Paris, le" and "18" preprinted. [b]Interlined above. [c]Canceled.

1. Edison noted on the letter that he received it on 14 October.

2. Richard Werdermann's low-resistance lamp (Brit. Pat. 2,477 [1878]) produced a small, low-powered light at the point of contact between a thin carbon rod and a large carbon disk. An article about Werdermann's light and system appeared in the 9 November *London Metropolitan*, under the heading "Gas and Water Notes." This article noted that commercial introduction of the system was being undertaken by J. Berger Spence of 31 Lombard St., and that Cornelius Herz assisted Werdermann with a public demonstration on 6 November. Cat. 1240, item 1023, Batchelor (*TAEM* 94:420); "The Werdermann Electric Light," *Sci. Am.* 39 (1878): 373.

-1469-

Equipment Specification: Electric Lighting

Menlo Park, N.J., Oct 2 1878[1a]

Mr. Kruesi—I want to have 5 lamps to show:—

1= They all want to have safety spark points on lever.[b]

2= They all want mounting on bases with bindposts[b]

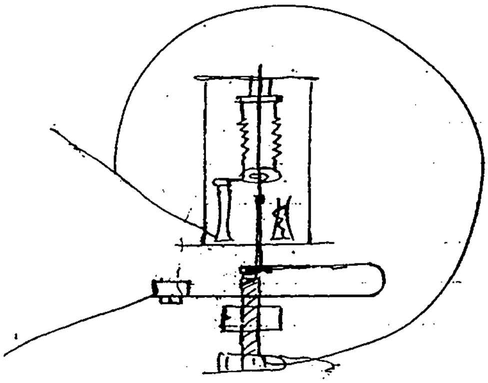
3= They all want to have no 28 Iridium wire on spirals and expansion[c] rods.[b]

4 They all want to have 14 copper running from bindpost up to light[b]

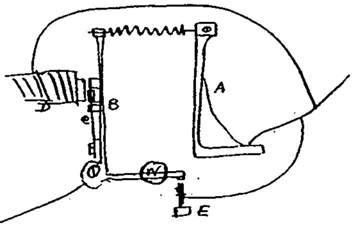
5 They all want no 28 copper wire connecting the shaft to bracket (round shaft points)[b]

6 Two of these 5, upstairs, have platina in, they also have thin copper connections from bindpost to working parts. Wire must be Iridium and copper thicker[d]

Kruesi Next one must have spring instead of lever like this and 2 iridium spirals of No 28 wire about 12 or 14 turns on each



Kruesi Make an experimental Instrument on a sounder base like this:—

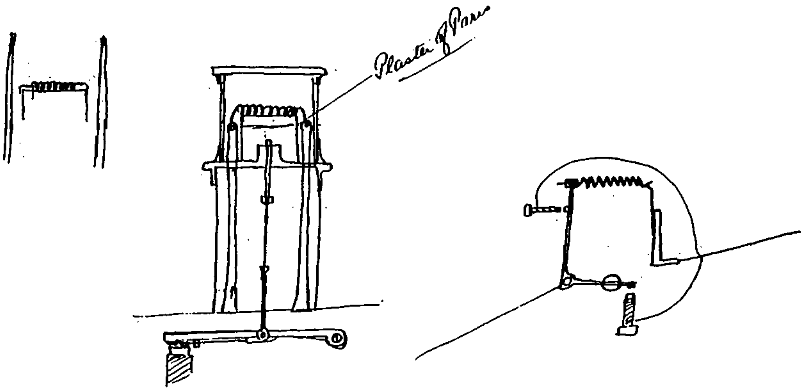


A is a bracket to hold one end of spiral

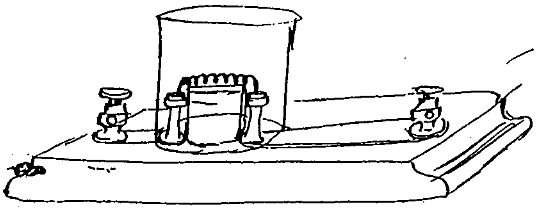
B is a pointed lever holding the other end, it is provided with a double point arrangement C.

D is regulating point. E is the safty point if the spiral busts the lever falls by weight W on to point

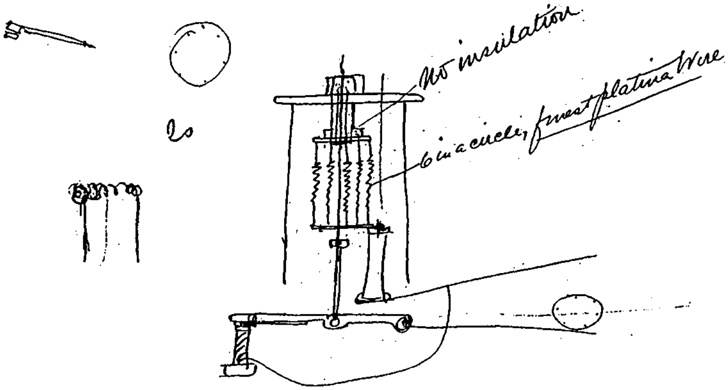
Make spring C very delicate and put 'hold back' close to points.[b]



Regulator and Safety catch.[2]



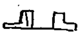
Make base with 2 posts & glass over to put anything in[3]
Quantity spirals[4]

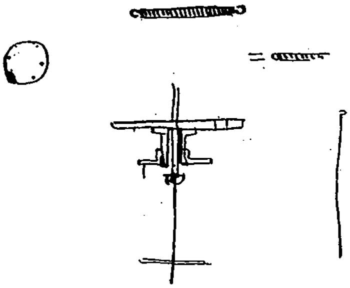


Make spirals of finest platina wire with hook at each end & six holes in each plate.

The spirals to be ¾ long without the hooks

The plates to be 1 in apart

Top ring  bottom ring



T A Edison
J Kruesi
G E Carman

Chas Batchelor
M N Force
Stockton L Griffin
W[illiam] C[arman]

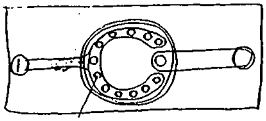
D, NjWOE, Lab., Vol. 16:77, 81, 83, 86, 85 (*TAEM* 4:550–52, 554, 553). Written by Charles Batchelor; first three pages on letterhead of T. A. Edison. Document multiply signed and dated. All except Vol. 16:77 copied by William Carman in Cat. 994:160–61, 170, Lab. (*TAEM* 3:250, 255). [a]"Menlo Park, N.J.," and "187" preprinted. [b]Followed by centered horizontal line. [c]Interlined above. [d]Followed by horizontal line.

1. The editors have combined this series of experimental lamp specifications into a single document.

2. Text is "Plaster of Paris."

3. The following day, Batchelor asked Kruesi to "make connections for the inside post, so that I can put them any where for circular or straight spirals." He also made additional drawings and indicated that Kruesi should place "the holes in the copper strip and through the base so that I can shift the post close to the other one or keep further away." Vol. 16:96, Lab. (*TAEM* 4:560).

4. Text is "no insulation" and "6 in a circle, finest platina wire."

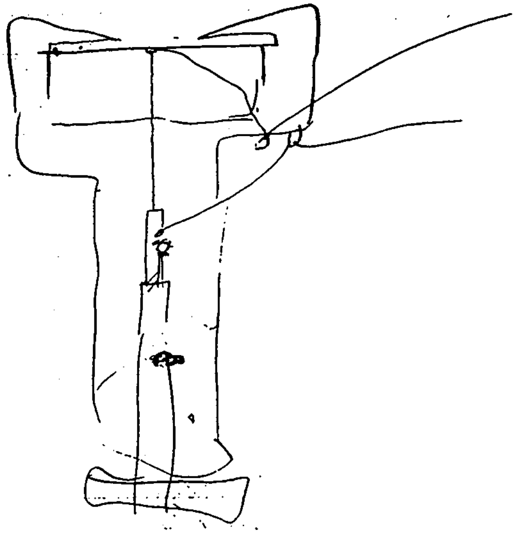


Drawing from Charles Batchelor's instructions; the slanted line from lower left leads to the copper strip and holes he mentioned.

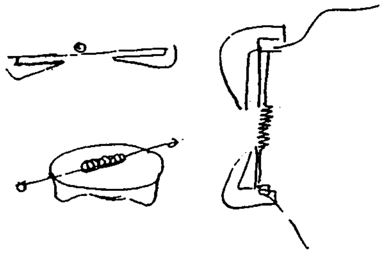
-1470-

Technical Note: Telephony

Menlo Park, N.J.,[a] Oct 2 1878

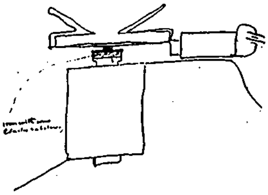


Platina Telephone receiver[1] passage of the current heats the ~~receiv~~ platina & expansion works the diaphragm=



air draft cools platina & alters the resistance.

T A Edison — Chas Batchelor
J Kruesi — M. N Force
G E Carman — Stockton L. Griffin



A telephone receiver design, using "iron with some elastic substance," in Edison's 27 September 1878 draft of a caveat.

X, NjWOE, Lab., Vol. 14:159 and Vol. 18:14 (*TAEM* 4:317, 1057). Letterhead of T. A. Edison; document multiply signed and dated. Vol. 14:159 copied by William Carman in Cat. 996:85, Lab. (*TAEM* 3:321). [a]"Menlo Park, N.J.," preprinted.

1. This design was one of several receivers Edison described in a 27 September draft caveat. This design and the one following, like those of 27 September, were intended to avoid infringing Alexander Graham Bell's patent by getting rid of the electromagnet in the receiver or by having it vibrate the diaphragm indirectly. Both of the designs here draw on Edison's efforts to regulate the current in his electric lamps by using the expansion and contraction of a platinum wire to alter the resistance in a circuit.

Another design in the draft caveat became patent application Case 159, but no patent ever issued and only the drawing is extant. The patent described in this application or one of the other 27 September designs may be the new receiver mentioned by Edison in Doc. 1461. Vol. 14:150–51, 153, 155–56, Lab. (*TAEM* 4:307–8, 310, 313–14); Patent Application Drawings (*TAEM* 8:754).

-1471-

To Grosvenor Lowrey

[Menlo Park,] Oct ~~4th~~ 3d[a] [187]8[1]

Friend Lowrey,

Go ahead— I shall agree to nothing, promise nothing and say nothing to any person leaving the whole matter to you. All I want at present is to be provided with funds to push the light rapidly.[2] Yours

T A Edison

ALS (letterpress copy), NjWOE, Lbk. 3:390 (*TAEM* 28:824). [a]Interlined above.

1. On 4 October, Lowrey and Hamilton Twombly went to see Edison at Menlo Park. Lowrey to TAE, 4 Oct. 1878, DF (*TAEM* 18:30).

2. On 5 October, Lowrey telegraphed Edison: "Those gentlemen prefer to wait until some day next week when the light is in good condition to be seen send your messenger down for the money I will leave it at the office for him answer as soon as you get this because if there are no trains coming down I will send my messenger out by the 3 oclock train." Edison replied that he would send a messenger. Lowrey advanced Edison three hundred dollars for electric light expenses with the expectation he would be reimbursed after the formation of the Edison Electric Light Co. Two hundred dollars of this money went to Lemuel Serrell for patent expenses. Lowrey to TAE, TAE to Lowrey, and Porter, Lowrey, Soren & Stone to TAE, all 5 Oct. 1878, DF (*TAEM* 18:31, 771); Electric Light Co. Statement Book, Accts. (*TAEM* 88:424, 427).

-1472-

Draft Caveat: Electric Lighting

Menlo Park Oct 3 1878

Caveat No. 3[1]

Electric Light Subdivision

The object of this invention is to subdivide the Electric Light and to make a Lamp which is self acting or controllable

The invention consists in the various devices for effecting this object, such devices I am now experimenting with to ascertain their availability for the purpose I have allready filed caveats in which several forms of Lamps are shown and described[2]

Fig 1[a]

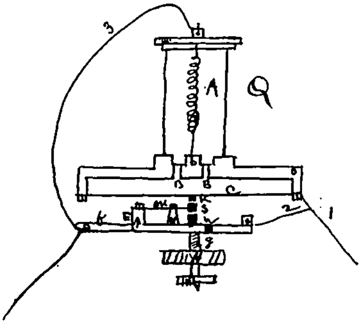


Fig 1 shows the method of causing the rise in the temperature to regulate the temperature of the spiral by the expansion of the inclosed air.[3] Q is the glass case made air tight .A. is the incandescent spiral wire D. is the bottom frame[4] work two air holes[5] B. and B′ lead from a chamber containing A into a space. C is a diaphragm air tight. when the spiral A becomes heated it instantly expands the air and this forces the diaphragm outward to a distant proportionate with[b] the rise in temperature in the centre of this diaphragm is a platina wire K faceing[b] this is another platina point[6] i on the end of a flexible spring m when the temperature rises in a to a certain point come in contact and short circuit the spiral it temperature falls and the air contracts the diaphragm recedes and the same operation goes on incessantly. H is an extra platina point[7] called "the safety "catch" this point is connected to the diaphragm. should the points K & i fail to make a connection owing to dust or oxide the temperature of A will rise still higher (but not to its melting point) this will force the spring m down and the spiral A will be short circuited. Just as if K & i had not failed an extra catch is arranged with the spiral which should it fuse will close the circuit. these safety catches are shown in figs 2. 3. 4. 5. 6. 7 & 8 the two springs which hold the spiral in all cases are allowed to fall back or forward when the spiral melts and close the circuit

fig 2

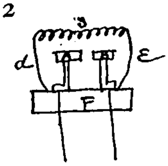


fig 3

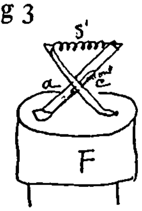
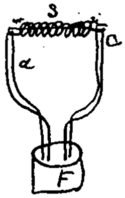


fig 4



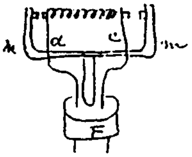


Fig 6

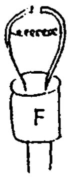


fig 7

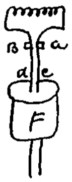


fig 8

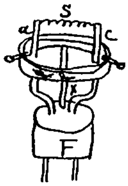


fig 9

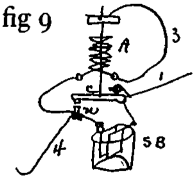


Fig 9 shews the secondary Battery S. B. arranged with the short circuit to prevent sparks in the points a small condenser might replace it.

fig 10

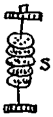


Fig 10 shews a spiral filled with some non conductor which becomes incandescent at a low heat

fig 11

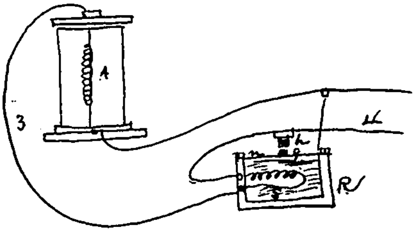


Fig 11 shews a seperate spiral S. immerced in air or a liquid in a seperate compartment covered by a diaphragm the operation is obvious

Fig 12

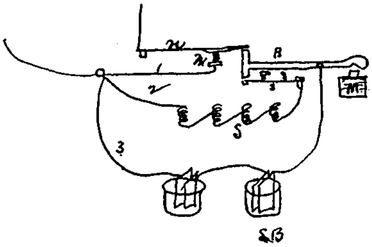


Fig 12 shows the spiral S in a house[8] worked by secondary Batteries S.B instead of the direct current the latter be used to charge the Battery[9] m and its lever is vibrated rapidly by a self make and break spring or an electric Engine clock-work or other motor may rotate a commutator to accomplish the circuit changes

fig 13

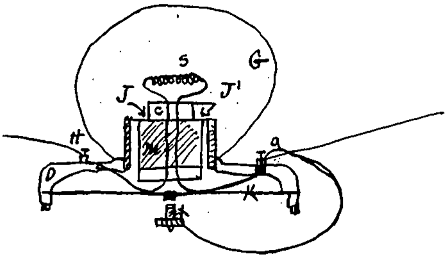


Fig 13 shows a spiral placed horizontally the two connecting wires being carried through a peice of chalk .C. or similar material m is Brass peice contaning the chalk provided with two air holes[10] i and i'. to allow the expanded air to remove the diaphragm K. outward and regulate the temperature of the spiral .S.

fig 14

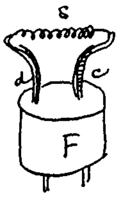


fig 15

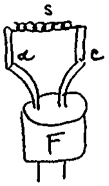


fig 16

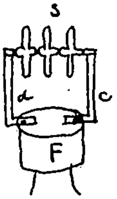


Fig 17

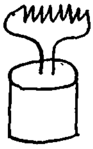


Fig 18

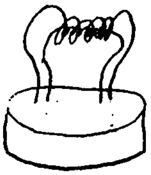


Fig 19

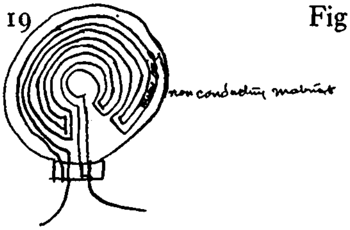


Fig 20

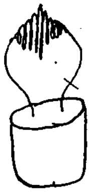


Fig 21

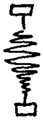


fig 22

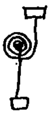


Fig 23

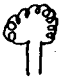


Fig 24

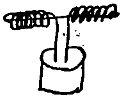


fig 25

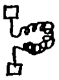


fig 26

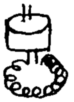


fig 27

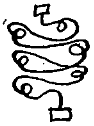


fig 28

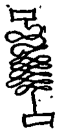


fig 29

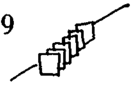


fig 30

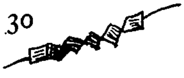


fig 31

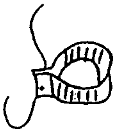


fig 32

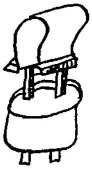


fig 33

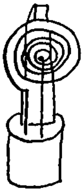


fig 34

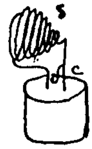


fig 35

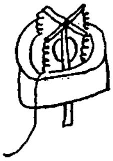


fig 36

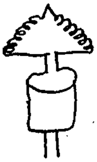


fig 37

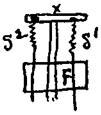


fig 38

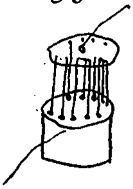
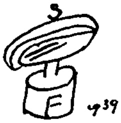


fig 39



Figs. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31 & 32 33. 34. 35. 36. 37. 38. & 39 are different forms in which I propose to experiment with in ascertaining the best form for giving light by incandescence[b] due to the passage of the Electric current through them

fig 40

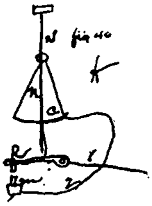


Fig 40 shows a regulating wire n and cone c of fine metalic foil kept incandescent.

fig 41

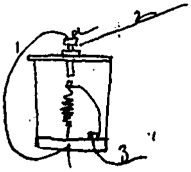


Fig 41 shows a simple method of regulating the temperature of the spiral S.

I shall probably claim regulating the temperature of a conducting body rendered incandescent by an Electric current by causing the expansion of air in which it is enclosed to move a diaphragm lever or equivalent substantially[b] as set forth

2d The double contact points or safety catches substantially as set forth

3d The various arrangement of the incandescent Bodies

Thomas A Edison

DfS (copy), NjWOE, Lab., Cat. 997:69 (*TAEM* 3:386). Written by William Carman. [a]Drawings together on two separate pages. [b]Obscured overwritten letters.

1. Figures 17–19, 21–22, and 39–41 were included in Edison's Caveat 85, filed 25 October 1878 (Edison Caveat 85). Drawings related to this draft caveat are in Vol. 16:59, 64, 66, 68–75, 78–85, 89, 91–93, 95, 104; and NS-78-005; both Lab. (*TAEM* 4:538, 543–48, 550–53, 557–60, 567; 7:814–18). Many of the drawings in the draft caveat have figure labels for parts which are not discussed in the text.

2. Though Edison had drafted two electric light caveats (Docs. 1427 and 1456), he did not file his first caveat on this subject until 7 October (No. 82). A second (No. 84) was filed on 12 October, and two others (Nos. 83 and 85) were filed on 25 October. Only the latter two are extant, but what may be a copy of one of the earlier caveats is in DF (*TAEM* 18:864). See Doc. 1576 and Edison Caveats 83 and 85.

3. See Doc. 1462.

4. "D" appears at the far right inside the frame.

5. Both are labeled "B."

6. Mislabeled "s."

7. "h" in diagram, below "s."

8. Perhaps "shunt" in original.

9. Should be "electromagnet."

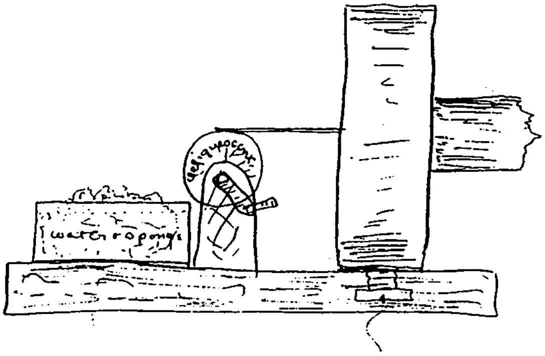
10. "J" and "J′" in drawing.

-1473-

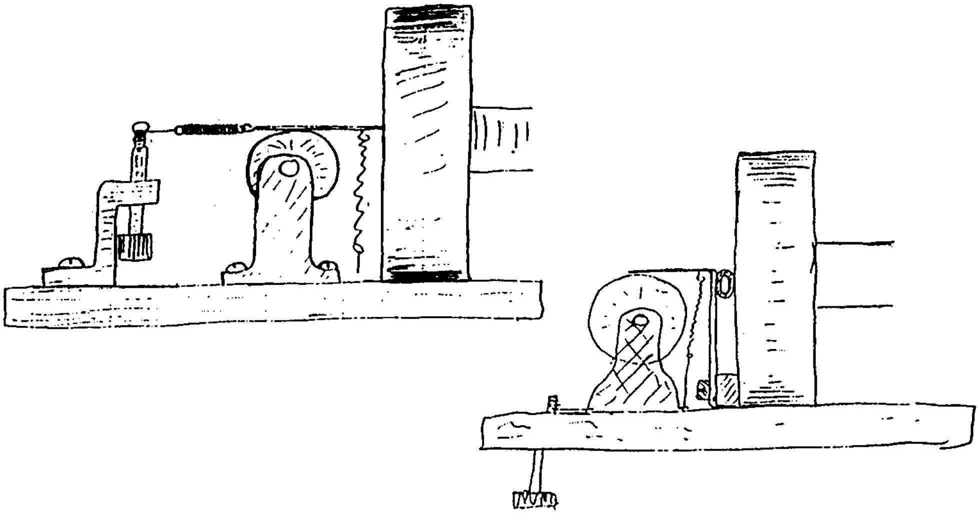
Technical Note: Telephony

Menlo Park, Oct 3rd 1878

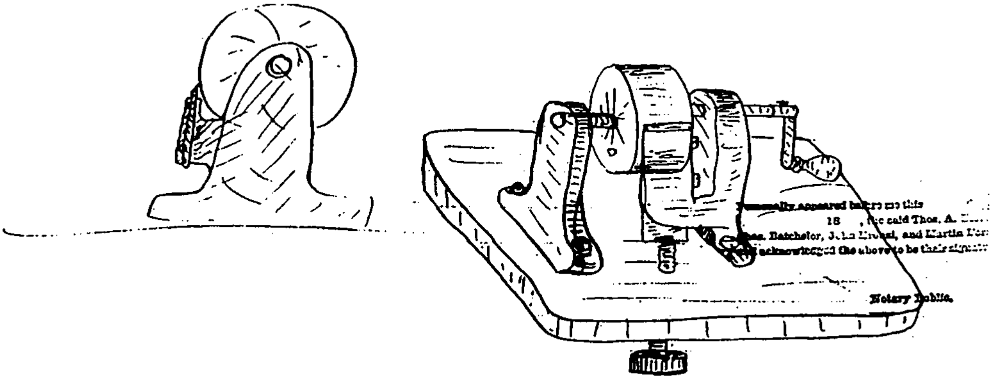
Speaking Telephone Receiver[1]



The above enclosed in a case to prevent evaporation deliquescent[2]



Attachment for truing Discs[3]



TAE
J Kruesi
G E Carman

C. P. Edison
Chas Batchelor
Martin Force

X, NjWOE, Lab., Vol. 18:15–16, 18, 17 (*TAEM* 4:1057–59). Written by Charles Edison; letterhead of T. A. Edison. Document multiply signed and dated. Copied by William Carman in Cat. 996:81–83, Lab. (*TAEM* 3:319–20).

1. Text is "water & sponge" and "deliquescent."

2. Text is "Boog Troup" (bug trap).

3. Another arrangement labeled "for truing up discs" and dated 2 October is in Vol. 18:13, Lab. (*TAEM* 4:1056).

-1474-

Telegrams: To/From William Wallace

October 4, 1878[a]
Menlo Park, N.J.,[b] 3:30 PM

Mr William Wallace

What is the price of duplicate of machine that you got the long arc from[1] Answer free

T A Edison

Ansonia, Conn 4:~~30~~55

T A Edison

One Thousand dollars to you twenty five per cent discount confidential

Wm Wallace

Menlo Park, N.J.,[b] 5:00

Wm Wallace

Have you one on hand

T A Edison

Ansonia, Conn 6:11

T A Edison

Can have one ready in three days

Wm Wallace

Menlo Park, N.J.,[b] 6:12 PM

Wm Wallace

Send it and draw at sight[2]

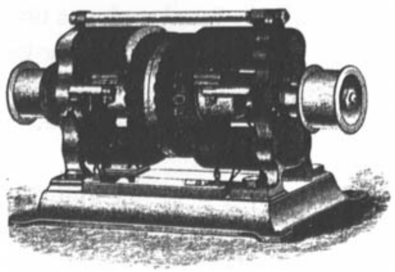
T A Edison

L (telegrams), NjWOE, DF (*TAEM* 17:937). Written by Stockton Griffin; letterhead of T. A. Edison. [a]Date taken from document, form altered. [b]"Menlo Park, N.J." preprinted.

1. The generator acquired by Edison, and which he subsequently referred to as the large Wallace, is on exhibit in the Menlo Park laboratory complex machine shop at the Henry Ford Museum and Greenfield Village (Acc. 29.1980.1832). According to Prescott 1878c (p. 423), "the machines made by Messrs. Wallace & Sons weigh from one hundred and twenty-five to three thousand pounds each, and are capable of producing a light equal to that of from one thousand to forty thousand candles. Some of them will even maintain the arc with the carbons three and a half inches apart." Edison was apparently referring to this latter feature in his telegram. According to the *New York Sun,* Edison's small Wallace generator produced light equal to 4,000 candles while his large one produced the equivalent of 24,000. "Edison's Electric Light," *New York Sun,* 20 Oct. 1878, Cat. 1241, item 963, Batchelor (*TAEM* 94:382); Edison's testimony, p. 42; John Kruesi's testimony, pp. 80–81, both *Keith v. Edison v. Brush.*

The basic design of these generators was conceived by Moses Farmer in 1875. They were subsequenly improved and manufactured

The Wallace-Farmer "large" dynamo.



in William Wallace's shop. Two different sizes of Wallace-Farmer dynamos were among several machines tested earlier in the year by Edwin Houston and Elihu Thomson for the Franklin Institute (their candlepower is largely unknown). Their report, reprinted in Prescott 1879 (439–72), noted the difficulty of obtaining sufficient power to maintain a large Wallace-Farmer generator at its proper speed. They also found the small Wallace-Farmer uneconomical because so much energy was lost in local action. Indeed, their primary criticism of the Wallace-Farmer design was its armature, in which the coils projected from the rotating disk, which produced "considerable resistance to rotation" and caused excessive heating. This defect was also noted by other investigators. Houston and Thomson 1878; Morton 1879, 52; Thompson 1886, 31.

2. The machine was probably sent on 7 October, the same day that Edison was billed for it. On 10 October, Wallace wrote Edison to tell him that the machine should be run at about 800 revolutions per minute and indicated that he should "have received it ere this." Cat. 1161:57, Accts.; DF (*TAEM* 17:942).

-1475-

Mining Circular

San Francisco, Oct. 4th 1878.

Dear Sir:—[1]

Mr. Thomas A. Edison of New Jersey has begun some scientific inquiry and experiments with a view of devising means for effectively and economically reducing the temperature in the deep workings of mines.[2]

He seems satisfied that he can accomplish this far enough to make it possible for men to work easily through an eight or ten hour shift.

To assist him in this, he has requested me to get as much information as possible regarding the present thermal condition of the principal mines on the Comstock lode, and the effectiveness of the means now in use for ventilating and reducing temperature.

Believing that, in view of Mr. Edison's well known reputation as an inventor, and the importance of the result likely to be obtained, you will readily furnish the information he wishes, I enclose a blank to be filled out with such information as you may have or can easily obtain,[3] and returned to me to be forwarded to him, or if you prefer, it may be sent directly to him, addressed, Mr. Thomas A. Edison, Menlo Park, New Jersey.

I trust that you will add any information likely to be of any use to Mr. Edison, and at as early date as possible, forward. Very truly Yours

Howard Schuyler[4]

ALS (electric-pen copy), NjWOE, DF (*TAEM* 18:595).

1. This circular letter was addressed to the secretaries of mining companies based in San Francisco.

2. When Edison toured a mine in Virginia City, Nev., during the summer, he had been impressed by the damp heat in the shafts. He told a reporter after his return to Menlo Park that "the perspiration just flowed off one when we got down to the 1,800-foot level. The air was full of moisture and, of course, there was no evaporation. We just breathed the dampness in through our lungs and sent it out through our pores." He noted that the dry outside air was far more comfortable despite being over 120 degrees. "Edison's Trip and Inventions," *New York Daily Graphic*, 28 Aug. 1878, Cat. 1240, item 858, Batchelor (*TAEM* 94:338).

After his return from the West, Edison proposed that reducing moisture in the shafts would lower the temperatures, which exceeded 150 degrees. He told *The New York Sun* that he knew the cause of the heat:

> "What makes the heat? The water. That's what makes it. Pumps are at work all the time, trying to pump it out, but the walls and levels and all nooks are dripping with moisture. This water evaporates and generates more heat. The way to stop it is to stop the evaporation. Do you see that little pond out there," pointing to the little basin near the laboratory. "A pint of cotton-seed oil thrown upon it will stop its evaporation. All right. Now if they will take a few pails of cotton-seed oil and go down into the mine where the men are working . . . and swash the walls with the oil, covering the standing water, it ought to stop the evaporation in the mine. The generation of heat would cease, and the air become much cooler. I believe that if the thing was tried it would prove a success." ["Four Hours with Edison," *New York Sun*, 28 Aug. 1878, Cat. 1240, item 859, Batchelor (*TAEM* 94:339)]

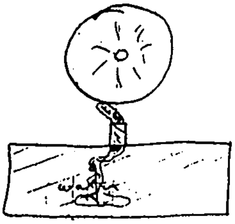
3. Schuyler enclosed a copy of the blank. On 16 October, Josiah Reiff forwarded to Edison what was probably a completed form, which has not been found. DF (*TAEM* 18:596, 16:242).

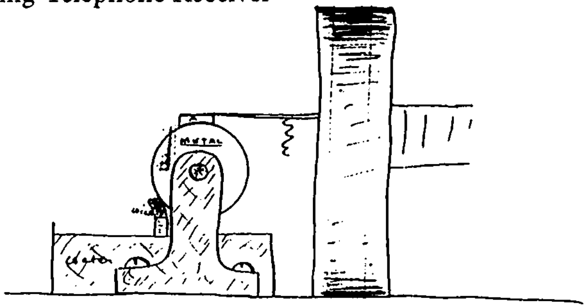
4. Howard Schuyler was a railroad civil engineer living in San Francisco. He had earlier helped to survey a transcontinental route, and about this time he supervised construction of the North Pacific Coast Railroad's line north from San Francisco. Langley 1878, 759; *Transactions of the American Society of Civil Engineers*, 36 (1896): 572–74.

-1476- Menlo Park, N.J.[a] Oct 4th 1878

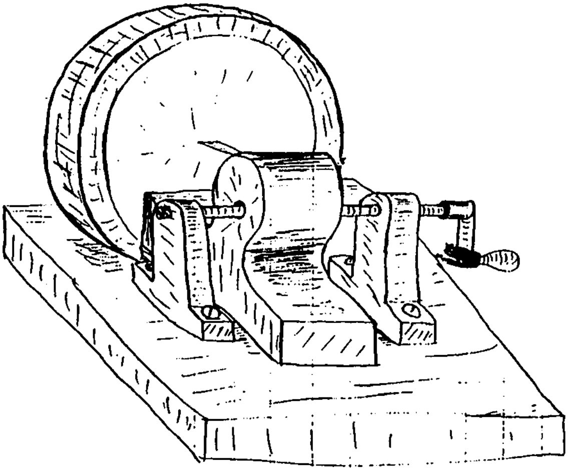
Technical Note: Telephony

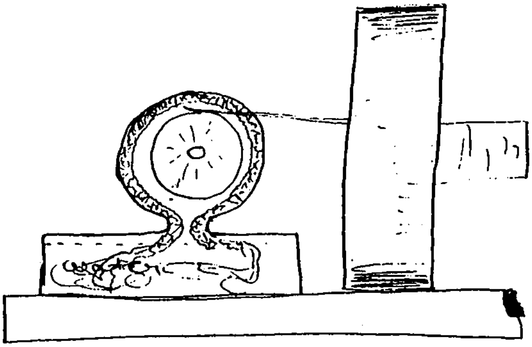
Speaking Telephone Receiver[1]





A—point made of caustic & chalk or other substances[2]





TAE
Chas Batchelor
Martin Force

Chas P. Edison
J Kruesi
G E Carman
W Carman

X, NjWOE, Lab., Vol. 18:19 (*TAEM* 4:1059). Written by Charles Edison; letterhead of T. A. Edison. Document multiply signed and dated. Copied by William Carman into Cat. 996:82–84, Lab. (*TAEM* 3:320–21). [a]"Menlo Park, N.J.," preprinted.

1. Text is "water" in the smaller sketch; "METAL," "wick," and "water" in the larger one.
2. Text is "water."

-1477-

To Theodore Puskas

Menlo Park N.J. Oct 5th 1878[1]

My Dear Puskas

I take pleasure in acknowledging the receipt of your favor of the 23d ult and the accompanying documents.[2] Am translating them by the aid of a dictionary. Will return them to you by the first steamer, which I think sails Wednesday Oct 9th.[3] They will go on one of the French line and will I think, just reach you in time and that is all—

Regarding the phono receipts, I think ½ would be a fair division.

I take pleasure in informing you that I have discovered a new telephone receiver in which no magnet is used. It reproduces the voice several times louder than any magneto receiver— Whispering is reproduced so as to be heard one foot away from the receiver.

The Electric light is going to be a great success.

I have something entirely new— Wm H Vanderbilt and friends have taken it in this country and on Monday next advance $50,000 to conduct experiments

I retain ½ half of the capital stock of the Co they are to form and also receive a royalty of $30,000 yearly if it proves more economical than gas which I am certain it will do. Vanderbilt is the largest gas stock owner in America.

Carbon telephones great success here. I furnish 200 carbon buttons daily to manufacturers (several firms being engaged) making them for the Western Union

I propose to send you through Gouraud a sample of each kind. I do not send them direct for fear of the French patent law, on the subject of imported articles patented in France—[4]

Very Truly

Thomas A. Edison.

LS, HuBPo, TP. Written by Stockton Griffin.

1. An undated draft by Edison is in DF (*TAEM* 16:364); a letterpress copy is in Lbk. 3:394 (*TAEM* 28:828).
2. See Doc. 1449 n. 2.

3. The same day as this letter, Edison received a cable from Puskas, "Power must be here by twenty first," to which he replied, "Papers go wednesday." DF (*TAEM* 19:937).

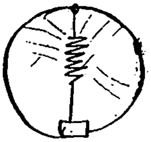
4. If the holder of a French patent imported into France objects manufactured abroad, but covered by the French patent, the patent could be voided.

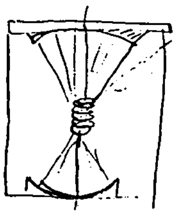
-1478-

Technical Note: Electric Lighting

Menlo Park, N.J., Oct 5 1878[a]

Caveat No 4 Electric Light[1]





I propose to use reflectors on the bottom and top of the straight glass holders, or in the case of a globe place the incandescent conductor in the centre so it will be in the universal focus Perhaps I can use something in the glass that will radiate well, thus throwing back the heat & allowing the light to pass through.[2]

If Iridium wire is so impure I propose to use a cable composed of a number of exceedingly fine wires twisted together instead of a ~~long~~ single strand with the same amount of metal in the stranded cable

TAE Chas Batchelor

X, NjWOE, Lab., NS-78-005 (*TAEM* 7:823). Letterhead of T. A. Edison; document multiply signed. [a]"Menlo Park, N.J." and "187" preprinted.

1. Though among several pages of drawings and notes made by Edison between 3 and 8 October in preparation for draft caveat No. 4 (Doc. 1485), this was not included.

2. In a note of 8 October, Edison wrote, "Paint the globes with substance that will reduce the refrangibility of the light." NS-78-005, Lab. (*TAEM* 7:825).

-1479-

From Moses Farmer

Newport R.I. Oct. 7″ 1878.

Friend Edison,

I enclose a small bar of pure Iridium—thinking that you may like to use it for a tracing point for one of your Phonographs—

I have for some time been intending to send it to you—but have neglected to to do— I would expect it to answer better than steel—& to be little inferior to a Ruby—because it is stronger—

While it is not tough & will not bear bending still it is not as brittle as a Garnet—

It is one of the bars that I have used for experiments on Electric Light—[1] It gives off much more light than does Platinum—because it will bear a higher temperature—

I will not however withstand so high a temperature as will a similar carbon bar in vacuo or in Nitrogen— I have obtained as much as 100 to 125 candle light from a square inch of platinum—five or six hundred or even more from Iridium—& over 14 000, from a sq. inch of carbon—

This latter is the most promising—when sealed tightly from oxygen either in vacuo—or in Nitrogen—

How soon will your new Phonographs be ready— Shall you sell or rent them—? If you sell them what will one cost me?—

Would you loan me one of your Carbon Telephones for a few weeks? & could I also get one of Phelps Crown Telephones for a few experiments— The Bell ~~h~~people have loaned me half a dozen or more for experiment—& have constructed them with different resistances—5 ohms 80—450—660 &c.—& with one pair I conversed through 623 000. ohms readily—& could hear with a shunt on the receiver which took off half the current— [Stocky?][2a] whose hearing is impaired wishes to know if you are making progress towards affording relief to deaf people. Truly Yours

Moses G. Farmer.

ALS, NjWOE, DF (*TAEM* 16:188). [a]Illegible.

1. Farmer first experimented with electric lights in 1858. The following year, he succeeded in lighting the parlor of his house in Salem, Mass., with platinum-foil lamps heated to incandescence by the current from a set of batteries and regulated by a variable rheostat. Farmer later exhibited his lamps at Charles Williams's shop in Boston, where he had a small laboratory. The exhibition of these lamps ended with the fire at Williams's shop discussed by Edison in Doc. 34, and it is likely that Edison had seen Farmer's lamps. Farmer published an account of his experiments in Prescott 1879 (515–25), in which he stated

> Pure iridium gave the best results of any of the metals. Alloys of iridium and platinum gave next best results, and next to this, platinum and palladium. Carbon, when inclosed in an atmosphere free from oxygen, also gave satisfactory results. Nitrogen, carbonic oxide and hydrogen are all suitable gases to surround the incandes-

> cent carbon. A vacuum is, perhaps, better, were it not for the difficulty of maintaining it.
>
> The important point is, that the higher the temperature of the incandescent substance, the greater the amount of light; and it is very noteworthy, that it requires nearly half as much current to make platinum shine in the dark as it does to fuse the wire or ribbon. Three quarters of the fusing current will not give one half the light that will be given off by seven eights of the fusing current. A flat ribbon of platinum will give nearly one hundred candle lights per square inch, if it be maintained within two hundred degrees Fahrenheit of the melting point, and I have been able to keep it at this temperature for hours and days. A bar of pure iridium, owing to its higher melting point, will give several times as much light as an equal and equally exposed surface of platinum; but, since pure iridium is neither malleable nor ductile when cold, it is costly to work it into convenient shape; hence, I have had recourse to alloys of platinum and iridium, which, although they do not give so much light as pure iridium, are yet superior to pure platinum.

It is not known if Prescott received Farmer's account before he sent this chapter to Edison for review in mid-November (Doc. 1492 n. 1). See also accounts of Farmer's electric light experiments in Defendant's Exhibit Silliman's Journal Article, *Sawyer & Man v. Edison (U.S.)*, (*TAEM* 47:916); Farmers's reminiscences, MGF; and Bright 1972, 44–46.

2. Unidentified.

-1480-

From George Gouraud

[London,] 7 Oct 1878[a]

Edison

Panic in Gas shares.[1] electric light occupying much public discussion large combinations forming to work it but hesitate which system to adopt.[2] how soon can Adams shew your system here. if you will cable what it is desirable to say about it, if anything I will publish such a letter in leading newspapers as will at least delay anybody's purchasing until your system can be seen

Gouraud

L (telegram), NjWOE, DF (*TAEM* 18:138). Message form of Direct United States Cable Co., Ltd. [a]"187" preprinted.

1. According to the 1 January 1879 issue of the *Telegraphic Journal and Electrical Review* (7:2): "On the 4th of October, when public interest in the new illuminator was beginning to rise, Mr. Edison telegraphed to London and Paris that he had solved the problem of sub-dividing the electric light indefinitely; and such was the influence of the inventor's reputation, and the excited state of the financial atmosphere, that a panic in gas shares, from which they have not yet recovered, immediately ensued." The telegram as quoted in the 10 October issue of *Nature* (18:610) stated: "I have just solved the problem of the sub-division of the electric light indefinitely." Neither the telegram nor other direct quotations of it have been found; however, it is very similar to the text

of Charles Batchelor's 16 September letter to James Adams (Doc. 1438). On 5 October at least one Paris paper, *L'Electricite* (*TAEM* 94:418), published an account of Edison's telegram. Regarding the price of gas in London and New York see "Edison's Electric Light: The Invention that is Expected to Finally Put Out the Gas," *New York Daily Graphic,* 14 Oct. 1878; "The New Inventions," ibid., 21 Oct. 1878; *London Daily News,* 9 Oct. 1878; all Cat. 1241, items 955, 961, 970, Batchelor (*TAEM* 94:377, 381, 385); "Gas in London and New York," *New York Sun,* 23 Sept. 1878, Cat. 1032:134, Scraps. (*TAEM* 27:923); "The Electric Light and the Gas Companies—Remarkable Effect of a New Invention in the Stock Markets," *Sci. Am.* 39 (2 November 1878): 272.

2. By mid October three electric light companies had been registered: the Electric Lighting Company and the British Electric Light Company, each with capital stock of £100,000, and the Sun Electric Light Company, with a capital of £5,000. At the same time, the London Court of Common Council expressed interest in electric street lighting. On 8 October, the London Stereoscopic Company, which was marketing Edison's phonograph, began using a Siemens arc lighting system in front of its Regent St. shop. "The Electric Light and Mr. Edison's Discovery," *Manchester City News,* 19 Oct. 1878; "The Electric Light," *London Daily News,* 9 Oct. 1878; both Cat. 1241, items 970, 991, Batchelor (*TAEM* 94:385, 402); Bowers 1982, 105, 108.

-1481-

Technical Note: Phonograph

[Menlo Park,] Oct 7 1878

Phonograph[1]

Cylinder stationary fast on shaft

Cylinder with 3 threads on one end[2]

Arm for mouthpiece on sleeve[a] with rack to engage in the cylinder thread

Arm with upright to stop against

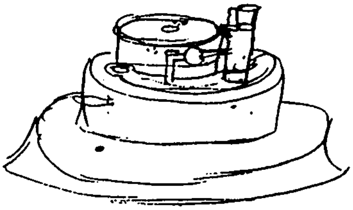
Friction device for holding up the sleeve when turning out

Fly[b] wheel on bottom of second shaft[3]

Cylinder[b] 9 in[ch] diam

Design[b] in Shell clockwork covered up & speak through mouthpiece

Make[b] arm that carries all mouth piece, stop pin, and rack swing from one common centre[4]



TAE
J Kruesi

Chas Batchelor
Geo E Carman
M N Force

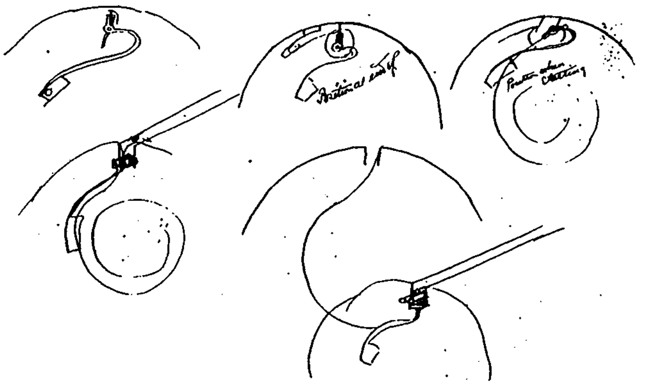
X, NjWOE, Lab., Vol. 17:149 (*TAEM* 4:1011). Written by Charles Batchelor. [a]Obscured overwritten letter. [b]Preceded by dash as check mark.

1. Work on this new design for a dictating phonograph apparently began about 5 October, when either Edison or Batchelor sketched several elements, including the flywheel arrangement (below a clockwork drive inside the base), the cylinder, and the method of arranging a roll of tin foil in the interior of the cylinder. Most of the drawings related to this design are by Batchelor and most date from 8 October. Measured drawings were prepared on 9 October and the last related drawing is dated 14 October. Time sheets indicate that five members of the laboratory staff spent 60 hours working on the dictating phonograph between 9 and 17 October. An account record shows that a total of forty dollars was spent making a machine between 11 and 18 October. There is no other evidence of work or experiments with this device, although the design was included in Edison's U.S. Patent 227,679, which he executed on 19 March 1879. Vol. 17:144–78, Lab. (*TAEM* 4:1007–37); Cat. 1185:284, Accts. (*TAEM* 22:681); time sheets for John Kruesi, Rudolph Hense, John Hood, Thomas Logan, and Alfred Swanson, DF (*TAEM* 17:740, 747–50).

Edison may have been speaking about this machine in an interview that appeared in the 20 October *New York Sun.*

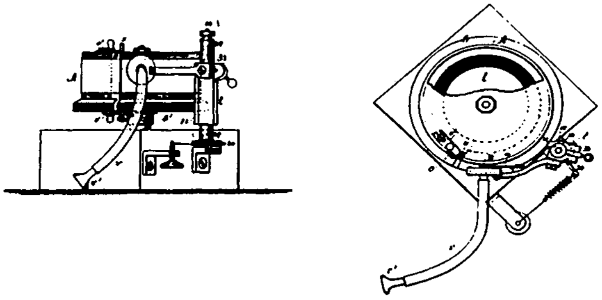
> A sheet of tin foil that will hold 4,000 words is now placed in the machine automatically. A perfected instrument runs by machinery, and you can stop it at any time by pulling a cord. The register is perfect, and it does not get out of gear. While it does not talk as loud as some of the old machines, it catches the labials and consonants perfectly and throws them out more evenly. Any man can dictate to it at his leisure, and his office boy can run out a half dozen or dozen words, stop the machine by pulling the cord, and write out what is desired. ["Edison's Electric Light," Cat. 1241, item 963, Batchelor (*TAEM* 94:382)]

2. This may refer to the set of drawings Batchelor made the following day showing the method of drawing the tin foil out from the reel within the cylinder and attaching it to the outside. At the bottom of this set of drawings Batchelor noted, "3 rods foil drawn one way first next time the opposite way so as always to place it between two rods." Vol. 17:167, Lab. (*TAEM* 4:1026).



Method of drawing tinfoil from the inside reel and attaching it to the cylinder.

3. This arrangement was shown by Batchelor in a drawing of 8 October. Vol. 17:162, Lab. (*TAEM* 4:1021).



Patent drawing of an arm and rack arrangement with flexible tube to allow operator to pause the phonograph during recording and playback.

4. The patent drawing shows an arm and rack arrangement connected to a flexible tube that allowed an operator to pause during recording and playback. According to the patent, the operator

> simply has to draw upon the flexible tube, which swings the parts so as to disconnect the screw-rack from the flange *s* of the cylinder. This at the same time moves away the recording or the phonet point. The cylinder A can continue to revolve, and when the operator is ready he releases the pull upon the flexible tube, and the parts commence to act again at the exact place where the operation was suspended, because the screw-threads will only drop together when the proper part of the thread *s* comes to the corresponding part on the rack 25. [U.S. Pat. 227,679]

-1482-

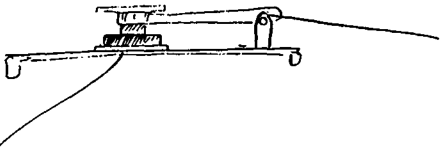
Draft to William Barrett

Menlo Park, N.J.,[a] [c. October 7, 1878][1]

Write Barrett & say will ~~re~~send him some more apparatus for his lectures Say that the Statement of Hughes that Clerac made resistance[b] tubes with carbon the resistance being varied by pressure and which were said to have been used to regulate the resistance of telegraph lines cannot possibly be true for the reason that ~~any changes~~ the amount of resistance that would be thrown in and out of the line by the difference of pressure would be ~~t~~so small as not to be detected by any apparatus worked on telegraph lines, that I have tried tubes of every size & character with carbon in every degree of ~~finer~~ division & no morse apparatus would detect the change that the thing is an after thought on the part of Hughes and one which fortunately can be proved untrue. ~~C~~Undoubtedly Clerac ma~~y~~de tubes filled with carbon that were adjusted to 50 10 500 ~~&~~or any number of ohms but that he filled tubes with carbon & obtained these resistance by varying the pressure[c] could[d] not possibly be true in 1856 if it cannot now be done; ~~I believe that it is rather unusual to bring~~ Nothing has ever been published that I can find where Clerac claimed[e] this ~~statement of Hughes was set forth~~. Regarding Mr Preece;

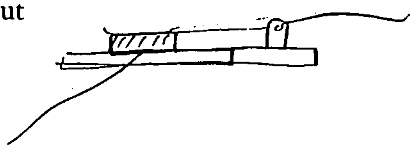
None of my letters in the public Journals accused him of anything but abusing my confidence; which he did from what cause I cannot imagine. When I said abused my confidence I did not imply that he gave to Hughes any ideas. But that he had abused the confidences I placed in his promise that he would bring ~~the matter~~ my Carbon telephone before the authorities & societies there a result which I had hoped for and which I sent him one[d] of my assistants with telephones. I gave him every chance to explain matters because in my first telegram which was widely published, I said, "If you do not set the matter right I shall with details." After waiting for some time and receiving no reply I then wrote the letters The hard words spoken of ~~were~~ came mainly from newspaper reporters who sympathized with me especially as nearly every scientific man here whom these reporters saw gave the opinion that there was no difference between the microphone & telephone You will notice that my letters are made ~~of~~up mostly of extracts from printed publications while Hughes' replies are insinuations & statements ~~not~~having nothing to do with the controversy. In one statement he says my apparatus was cumbersome & did not work well that an induction coil had to be used. (~~that Cl with~~ one week afterwards he applies an induction coil to his device to make ~~it~~ speech[b] audible to an audience[f] & writes to that effect to a French paper—) He then drags Clerac in makes a statement that an account of it[g] was published in the Journal Telegraphique of 1873. ~~whereas there is not one word about it~~ & insinuates that my tubes in 1873 was a singular coincidence;[d] Yet not one word is found about it in the Journal Telegraphique of 1873; I am quite willing ~~to set Mr Pr~~ to explain matters when Mr Preece shall come out before our society of Telgh Engineers and explain Scientifically the difference between the[h] Carbon Telephone & Microphone;

It may astonish you when I state that I have a peice of paper with sketches of my own and Mr Preece when he was here in the laboratory in which an instrument is drawn precisely the same as is sold by one firm in London as the Hughes Microphone This drawing was made to shew to him[i] the effect of pressure by weights, thus[2]



~~His name is shown one of my scrap books~~

Again the London Engineering left out of the article I sent them the cut



and[d] kept all the others in probably because it looked too much like the microphone; again they left out the paragraph where I said I used conducting sulphides oxides, finely divided metals ~~etc and then~~ also several[d] paragraphs[d] about the non use of a diaphragm but in every case giving credit to Hughes for just what they suppressed from the article. Now the ~~pro~~Editors of Engineering could not have any object in suppressing these paragraphs[d] and both Mr P & H had hence I cannot but infer that it was their handiwork, if so why was this necessary if everything was as they claimed.

~~The fact of the matter is~~ If prior publication is of[d] no use: what protection has any scientific man ~~against just~~[b] ~~such matters as this, against a person who dont read the journals and designs apparatus in~~

Excuse me for writing so long a letter but I feel very grieved over ~~this matter~~ Preeces failure to understand Hughes work and to defend me, or at least explain and also at his subsequent action. He must have known that I was the first to use finely divided conducting matter to translate sonorous ~~w~~vibrations into electric waves. Exactly what Hughes did.

The Motorgraph action was discovered by me in holding my finger on a tin recording point of a Bain recorder in 1872. ~~A~~[b] ~~Motion to a lever was moved~~[j] ~~was obtained in 1874~~ A machine was designed & made in 1874 whereby vibrations were obtained, levers moved etc.

The Bell telephone was made an used by me in 1875, before Bell had invented his. I used several of them for receiving musical vibrations but Bell had the merit of discovering that such Receivers would act as transmitters. ~~Litigation~~ This is the point of the litigation in the patent office at the present time.

TAE

ADfS, NjWOE, DF (*TAEM* 16:194). Letterhead of T. A. Edison. [a]"Menlo Park, N.J." preprinted. [b]Interlined above. [c]"by varying the pressure" interlined above. [d]Obscured overwritten letters. [e]"Clerac claimed" interlined above. [f]"to an audience" interlined in margin. [g]"of it" interlined above. [h]"difference between the" interlined above. [i]"to him" interlined above. [j]"was moved" interlined above.

1. The letter as sent to Barrett was dated 7 October. See Doc. 1507.

2. The paper with this and other drawings mentioned by Edison has not been found, though there are similar drawings from the period of Preece's 1877 visit (cf. Doc. 920 [fig. A]). Preece and Edison did discuss the pressure relay and the first pressure tests of plumbago also took place during that time (Docs. 909, 937, and 941).

-1483-

Draft to George Gouraud

Menlo Park, N.J., Oct 8 1878[a]

Working up details of
~~Was~~ Gouraud.

Say nothing publicly about light let them go ahead I have only correct principle. Requires six months to work up details. Gas men here hedged by going in with me.[b] Twenty telephones go on seventeenth. dont wait for new things go ahead on what you have. sample new receiver be sent soons ready.[1]

= Edison

⟨Copy sent to Ward⟩[2c]

ADfS, NjWOE, DF (*TAEM* 18:139). Letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted; date written by Griffin. [b]"Gas . . . me." interlined above; "by" and "ing" interlined above and below "go" in main interlineation. [c]Written by Stockton Griffin.

1. On 3 October, Gouraud had cabled: "Send immediately twenty transmitters only with binding posts also new receivers without magnet if ready. Takes too long to make anything here." On 7 October he again cabled: "Are any more telephones on the way. Shall we go ahead & make a lot like those already received or wait new model without magnet receiver. Hurry forward a lot after model you most approve." DF (*TAEM* 19:936, 938).

2. A clean version of this, for transmission to London, was sent the same day with a covering note to George Ward of the Direct United States Cable Co. Lbk. 3:396 (*TAEM* 28:830).

-1484-

From Charles Bailey

New York, October 8th 1878.[a]

Dear Sir:

Please find herewith my report of sales for the month of September, which shows a gratifying continuance of public interest in your invention; the demand however for these merely experimental instruments cannot be expected to last many months longer, but will I hope be replaced by Sales of the "Standard machine" which I understand you are perfecting.[1]

While appreciating that you are always very busy we should be glad to see you oftener when in town. Very Truly

Chas. E. Bailey Treas.

ENCLOSURE[b]

New York Oct. 8. 1878.[c]

Statement of Phonographs Sold and del'd. in September 1878.[2]

A. M. Musser[3] (Royalty paid)[4]	#1.	—
Jacob Backus " "	#8.	—
H. A. Parr " "	#19.	—
Silver & Laws	#80.	185.
J. N. Fartenburg	#86.	185.
M. T. Higginbotham	#91.	185.
E. B. Hamlin	#98.	185.
Ditto	#99.	185.
W. L. McGee	#100.	185.
E. H. Harvey	#102.	135.
A. C. Lovell	#105.[5]	185.
E. B. Hamlin	#106.	185.
M. F. Lopez	#107.	185.
J. P. Calvert	#108.	185.
Orrin Bros	#109.	185.
E. B. Hamlin	#110.	135.
		$2305[c]

20%[d] on above amt is $461.[c]

This amt. $461. is accordingly passed to the credit of your a/c this day.[e]

E[rrors].&O[missions].E[xcepted].[c]

ALS, NjWOE, DF (*TAEM* 19:192). Letterhead of Edison Speaking Phonograph Co. [a]"New York," and "18" preprinted. [b]Enclosure is an AD written by Bailey on ledger paper. [c]Underlined twice. [d]"20%" preceded by line across left column. [e]"This . . . day." preceded and followed by lines across left column.

1. Edison Speaking Phonograph Co. royalty reports to Edison show that forty-six large phonographs had been sold by the company to prospective exhibitors during May 1878 and another twenty-seven in June. Only three sales were reported for July, one of which involved an exchange; fifteen more phonographs were sold in August, while three previously sold machines were sold again. Sales rose in October to twenty-three, after James Redpath's royalty ended, and the total was again $2,305 with Edison receiving $461. In November, however, only ten phonographs were sold and Bailey remarked that it was "to be expected that the interest in a mere exhibition machine will die out but Mr. Johnson hopes to produce something before long that will excite a new demand." Edison Speaking Phonograph Co. royalty statements for May–November 1878; Bailey to TAE, 4 Dec. 1878; all DF (*TAEM* 19:181–83, 187, 190, 193, 198, 200–1).

Similar concerns about future sales had been expressed two weeks earlier by Theodore Puskas, who reported total sales of about 150 phonographs in Europe but asserted that there were "over 200 on hand which I cannot sell." Puskas to TAE, 23 Sept. 1878, DF (*TAEM* 16:110).

2. This is an example of the monthy royalty statements Edison received from the Edison Speaking Phongraph Co. reporting the purchaser's name, the serial number of the phonograph purchased, the price for each, and the amount due as a royalty. The machine's number would be found on each of its major parts. Regarding phonograph prices see Doc. 1397 n. 1. Other statements from 1878 are in 78-031, DF (*TAEM* 19:173); similar reports exist for January through July 1879 in 79-032 (*TAEM* 51:681).

3. No attempt has been made to identify the purchasers.

4. The phonographs numbered 1, 8, and 19 were listed in the royalty report for May as having been sold; it is evident from the reports that when a sale failed to go through or a machine was returned, Edison kept the royalty he had been given for that sale but received no royalty upon its resale.

5. This machine is on display at the Henry Ford Museum in Dearborn, Mich. (see Doc. 1416).

-1485-

Draft Caveat: Electric Lighting

Menlo Park NJ Oct. 8 1878

Electric Light Subdivision Caveat No 4[1]

The object of this invention is to subdivide the Electric Light by causing the Electric Current to pass through conducting Bodies and render them incandescent

The invention consists in the various devices for accomplishing this object.

Fig 1[a]

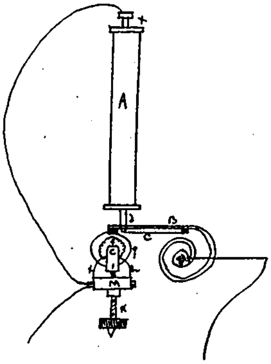


Fig 1 shows a peice of metallic foil ~~a~~A. through which the current passes. the top of this foil is secured to the top of the globe holding it at X an extension arm d is arranged so that the contact spring B rests upon it and places tension on the foil the extreme end of B is faced with platina contact is made on a platina faced wheel g this wheel is secured to a shaft which ~~secures~~ causes an upward or downward motion without turning by the action of the screw n. M is a rigid stud in which the devices are secured on the shaft of the platina wheel g is a ratchet wheel with two springs[2] h & K engaging in its teeth when the screw n is adjusted downward the ratchet and wheel g is rotated about 1⁄16 of an inch thus bringing clean platina for contact purposes every time the lamp is used with the wheel ½ an inch in diameter a fresh surface would be brought to face that on the spring B once daily for 24 days which is increased as we increase the size of the wheel. c is a small spring attached either to the spring B or to the frame of the instrument the object of this spring is to keep the foil A stretched when the spring B comes in contact with the wheel g

Fig 2

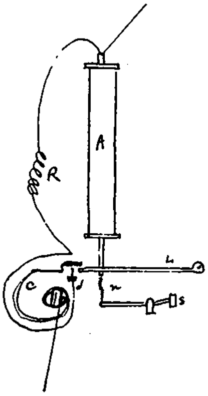


Fig 2 shows a resistance R inserted in the circuit when the foil A is thrown out by the expansion acting on the lever L to seperate it from the spring c.

Fig 3

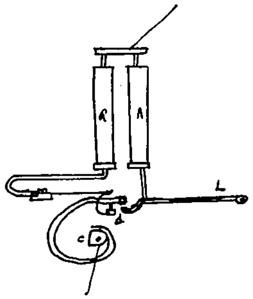


Fig 3 shows in place of a resistance R a second foil

Fig 4

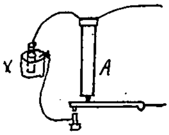
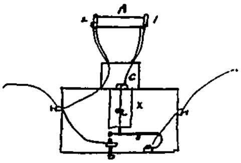


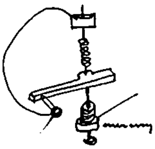
Fig 4 shows a device for lessening the spark when the foil A expands and brings the points together the battery X acts to send a current through A in the opposite direction to the main current

Fig 5



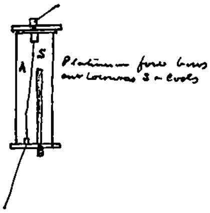
In fig 5 C is a chalk cylinder 1 & 2 are springs[3] connected to it between the springs is the foil A X is a cylinder containing a regulating wire n this wire short circuits itself as well as the foil A when[b] the temperature approaches the melting point

Fig 6[4]



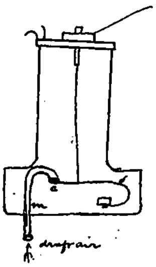
In fig 6 the short circuiting lever is worked by tension[b] the expansion of the spiral serving to bring the lever around to the short circuiting point

Fig 7[5]



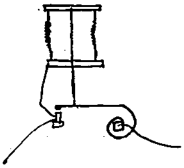
In fig 7 a rod s of silver placed in close proximity to the foil A cools A[c] when it expands to such an extent that it bows out and touches the silver

Fig 8[6]



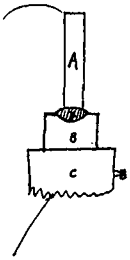
In fig 8 A is the foil d a lever with a pad at c closing the orifice of the tube m through which a draft of air endeavors to pass when the foil expands to a certain degree the pad at c leaves the tube m and a draft of air passing to a instantly cools it by radiation

Fig 9



In fig 9 a double spiral is used to give light and a single wire for regulation

Fig 10



In fig 10 a carbon rod A dips in a molten mass of metal X in the carbon block B this gives brilliant incandescence. a carbon rod A should be fed downwards by proper mechanisms as it wastes away

Fig 11

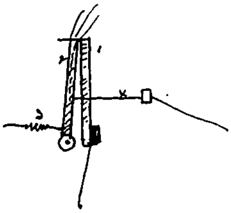


Fig 11 shows two carbons 1 & 2 placed within a short distance of each other and in contacts at their ends when no current passes. X is a platinum rod[d] inclosed in the circuit and secured to the carbon 2 when the current passes X expands and with the assistance of the spring s seperate the carbons and establishes the arc

Fig 12

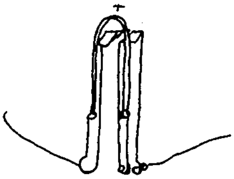


Fig 12 shows the expansion of a spring X by the heat of the arc

Fig 13

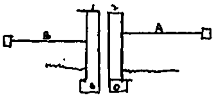


Fig 13 shows double expansion wires A & B

Fig 14

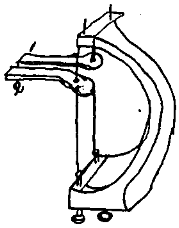


Fig 14 shows two carbons 1 & 2 working on torsion wires the arc being maintained by repulsion

Fig 15

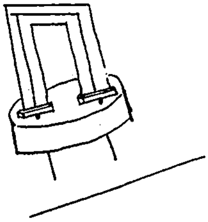


Fig 15 shows a foil for incandescence on a peice of chalk it is ribbed in the center for strength

Fig 16

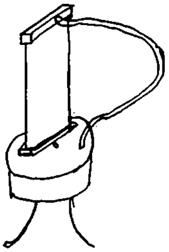


Fig 17

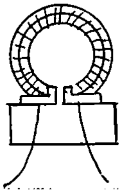


Fig 18

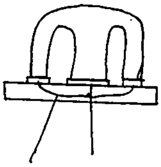


Fig 16–17 & 18 are similar

Fig 19

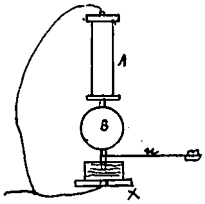
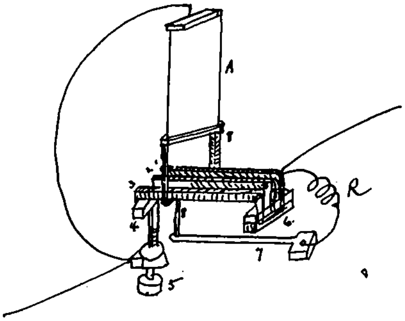


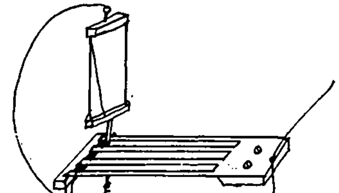
Fig 19 A is the foil B a weight short circuit takes place in a cup of mercury X

Fig 20[7]



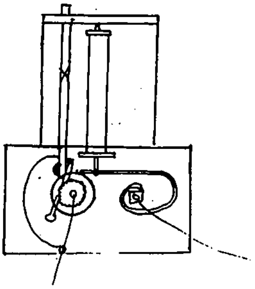
In fig 20 several levers[8] ~~are~~ 1 2 & 3 are used to make contact should one fail the others connecting should all fail to connect with 4 and short circuit the foil it would still be saved by the stirrup 8 leaving the levers and the current passing through spring 7 and resistance R 5 is the adjusting screw for the contact 4. 6 is a mercury cup to insure contact together of all the levers

Fig 21[9]



In fig 21 spring replaces the levers of fig 20

Fig 22



In fig 22 the object is the same as in fig 1 but rotation of the platina wheel is obtained by the expansion of the Zinc rod X. every time the foil becomes incandescent a click in the rod engaging in the ratchet on the platina wheel.

Fig 23

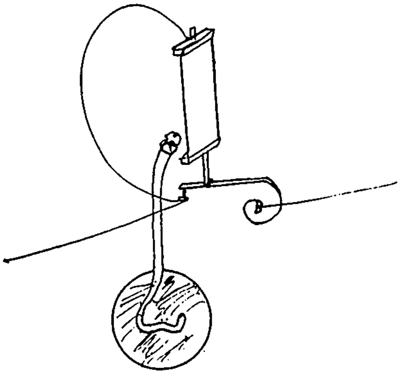


fig 23 shows the^{e} ordinary regulator with the addition of a lamp and wick which assists the incandescence of the foil and which for some purposes is a useful adjunct

Fig 24

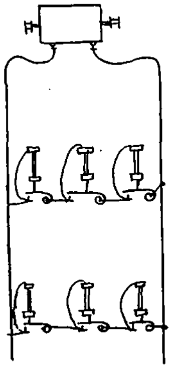


Fig 25

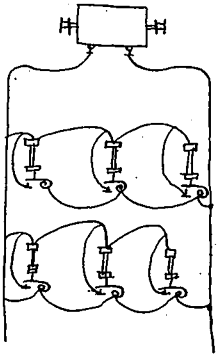


Fig 26

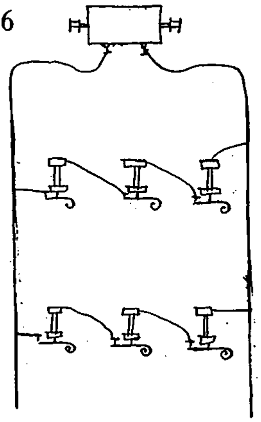


Fig 24–25 & 26 shows methods of connecting the spiral ~~o~~in a magneto electric circuit

Fig 27

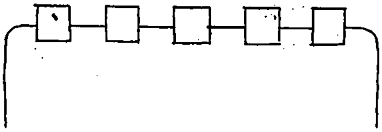


Fig 28

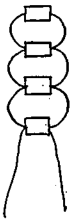


Fig 27 & 28 shows methods of connecting several regulators in 27 they are connected for intensity in 28 for quantity[10]

Df (copy), NjWOE, Lab., Cat. 997:77 (*TAEM* 3:389). Written by William Carman. [a]Drawings together on three separate pages. [b]Obscured overwritten letters. [c]"cools A" interlined above. [d]"rod" interlined above. [e]Interlined above.

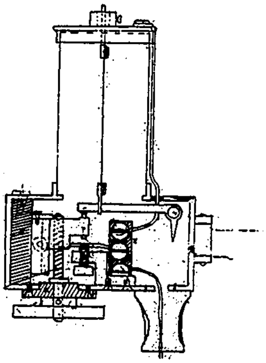
1. Figures 4–23 and 27–28 were included in Edison's Caveat 83, filed 25 October 1878 (Edison Caveat 83). Drawings related to this draft caveat are in Vol. 16:98–101, 104–5, 107–9, 111–13, 115 and NS-78-005, both Lab. (*TAEM* 4:561–64, 567–69, 571–73, 575; 7:819–26). Many of the figures in the draft caveat contain part labels that are not discussed in the text.

2. Above "M" and to the left and right respectively.

3. Located to the right and left of "A," which is at the top of the drawing.

4. Text is "mercury."

5. Text is "Platinum—foil bows out touches S—cools." Another version of this drawing is in NS-78-005, Lab. (*TAEM* 7:825) with the following description: "Platinum wire X heated to incandescence by current bows outwardly toward S & touches it when it reaches a certain temperature thus cooling it." The platinum wire or foil is the thin line in the center of the lamp, the silver is the thicker line to the right.



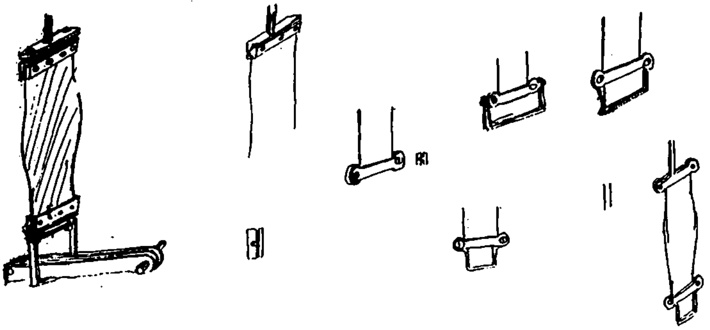
Charles Batchelor's measured drawing of a foil-lamp design.

6. Text is "draft air," the foil is unlabeled.

7. Edison's U.S. Patent 218,866 includes this design.

8. At left center.

9. On 3 October, Charles Batchelor made a measured drawing of a lamp that appears similar in design to those shown in figures 20 and 21



Methods of attaching platina foil burners.

and, on the same page as another drawing of a similar lamp, he illustrated various methods of fastening the platina foil. Edison's U.S. Patent 218,866 includes this design. Vol. 4:100–1, Lab. (*TAEM* 4:563–64).

10. Cf. Doc. 1098.

-1486-

To George Bliss

[Menlo Park,] Oct 9 [187]8

Dear Sir

Genl Stager informs me that the W.E. Mfg Co have plenty of pens in stock but that they will not let them go except for cash and complains that you are behind in payments and that is the whole trouble— I hope this can be fixed up otherwise the business is ruined— Puskas will telegraph me on the 28th of this month $8,000[1] of which deducting some expenses I suppose ⅙th will be yours.[2] Will notify you when it is rec'd and you can draw at sight. Very Truly

T. A. Edison G[riffin]

L (letterpress copy), NjWOE, Lbk. 3:399 (*TAEM* 28:833). Written by Stockton Griffin.

[1] See Doc. 1449 n. 1.

[2] As per the terms of their agreement of 17 December 1877. Kellow (*TAEM* 28:1195).

-1487-

To Hilborne Roosevelt

[Menlo Park,] Oct 9 [187]8

Dear Sir

I understand that the President of the Phono Co[1] says that I am not entitled to any royalty on phono exhibitions.[2] I should like to be informed of this decision officially.[3] Very Truly

T. A. Edison G[riffin]

L (letterpress copy), NjWOE, Lbk. 3:398 (*TAEM* 28:832). Written by Stockton Griffin.

[1] Gardiner Hubbard. Although William Applebaugh had been named president when the Edison Speaking Phonograph Co. was incorporated, the functional authority always was Hubbard's and he soon assumed the title. Doc. 1305 n. 2; Eustis Hubbard to Gardiner Hubbard, 17 Sept. 1878, Box 1205, NjWAT.

[2] No inquiry from Edison nor any response to this effect has been found. The contracts binding the various exhibitors of phonographs to pay royalties to the company terminated on 1 October 1878, and Edison knew that by late September several thousands of dollars had been received, but the company's 8 October royalty report to him (Doc. 1484) made no reference to that revenue.

3. Apparently Edison addressed this to Hilborne Roosevelt because he had suggested to Edison in September that various changes be made in the Edison Speaking Phonograph Co. as well as in the disposition of the rights to use the phonograph in toys. Both Edward Johnson and Uriah Painter had urged Edison to discuss the matter with them before trying to settle anything with Roosevelt. Roosevelt indicated the next day that he thought it proper that Edison get a share of the company's exhibition royalties, and the following day he proposed alterations in the company's contract with Edison to make that explicit. Eventually Edison was credited with $1,031.91, a twenty percent share of the net royalties of $5,159.55. Johnson to TAE, 21 Sept. 1878; Painter to TAE, 26 Sept. 1878; Roosevelt to TAE, 10 and 11 Oct. 1878; Edison Speaking Phonograph Co. royalty statement for December 1878; all DF (*TAEM* 19:123, 125, 128, 130, 204).

-1488-

To Henry Morton

Menlo Park, N.J., Oct. 10, 1878.

Dear Sir:—

Your favor of the 9th has just been received.[1] The *Sun* article was *somewhat* exaggerated.[2] But it is safe to say that I have some new ideas in regard to the electric light, more especially relating to the infinite subdivision of the same. I expect to put in at least 6 months solid work perfecting it. Am just ordering a 50 H.P. engine for this line of experiment.[3]

I do not think I will enter the lecture field for several years.—Can't spare the time.—and have no inclination that way.[4] Very truly yours,

T. A. Edison, G[riffin].

PL, NjWOE, Lit., *Edison Electric Light Co. v. U.S. Electric Lighting Co.*, Defendant's Exhibit Edison-Morton Letter (*TAEM* 47:884).

1. Morton's letter is in DF (*TAEM* 17:690).

2. This refers to Doc. 1439. In his 9 October letter (see note 1), Morton had told Edison that "so many people ask me about it that I will take the liberty of inquiring if you really have hit upon some new idea in connection with the electric light, or if the Sun article was only 'taffy.'" A week later, Morton gave a lecture on the electric light to the American Gaslight Association during which he stated: "In the subdivision, as gas is now used, there is not even the prospect of anything being done. Even Mr. Edison says not for some years to come." "Gas and Electricity," *New York Herald*, 18 Oct. 1878, Cat. 1240, item 958, Batchelor (*TAEM* 94:319); Morton 1879.

3. See Doc. 1500 n. 1.

4. In his 9 October letter (see note 1), Morton told Edison that a Mr. Pugh wanted Edison to lecture. Pugh subsequently engaged George Barker (see Doc. 1582 n. 4).

-1489-

From George Barker

Philadelphia, Oct. 10, 1878.

My dear Edison:—

On looking up the subject of titanium, I find that it has never been[a] obtained except in the form of powder; in which form the dealers in rare chemicals sell it; as you will see by the catalogues of Trommsdorff, Schuchhardt, and Karlbaum which I have mailed you today.[1] Since it decomposes water at 500°, it must take fire and burn to oxide at a red heat or less. I think silicon is better than titanium, for light. As to Rutile, there is a mineral dealer here who I think would supply you. If you say so I will get the price from him. If you only want a small quantity, I think you had better buy the titanic acid already made. This can be converted into titanic tetrachloride, and the vapor of this passed over heated sodium to obtain the metallic titanium.

I sent you yesterday an ounce bottle of chemically pure oxalate of cerium, precipitated from an acid solution by ox~~o~~alic acid. If you want more, I can send you another bottle. I would like to know if you find it any better for your purpose than the commercial oxalate, which contains Di[2] and La.

How does your new light come on? Mr. Bentley called me on the telephone yesterday and introduced me to a Mr. Wise[3] of the Permanent Exhibition here, who told me that Brush's machines[4] were not giving satisfaction, and he desired to know about your invention. I told him your expectation was to make it public in a few weeks and that you had promised it to me for my lecture on Nov. 14th. I told him he ought to go over to N.Y. to the American Institute and see how Wallace's machines worked lighting up that building. By the way you were over there last night I heard. What success has Wallace in lighting up? I believe his machine is the best in this country yet and I should like to see a comparative test made between that and the Siemens machine.[5]

Speaking of Wallace, I felt a little sorry for him when you told me the arrangements you had made for putting your new light on the market. I wish you had let him know of the plan, so that he could have gone into the company on equal terms with the men whose names you gave me. He is a capital fellow and an honest man, and I should like to have him have a chance in your new method of lighting.

So soon as you can spare one, I hope you will send me one of the new lights to experiment with with my Gramme machine[6] in preparation for my lecture. You know I am expecting you and Bachelor over to help me show that new light.

Can you tell me where the cap is for the cone of the tasimeter I have? You had it in your bag.

I enclose some papers of yours I had & a letter which came to St. L. after you left.[7] Draper would like your Tasimeter paper in the form of a report to him.[8] May I make the change? Ask Bachelor to send me these things soon. With best wishes Cordially yours

George F. Barker.

Dont forget the cartes-de-visite.

ALS, NjWOE, DF (*TAEM* 16:205). [a]Obscured overwritten letters.

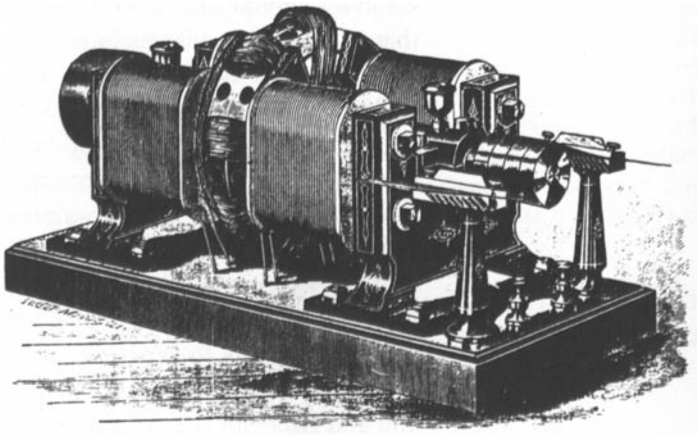
1. The catalogs of Theodore Schuchardt of Görlitz, C. A. F. Kohlbaum of Berlin, and H. Trommsdorff of Erfurt are pasted into Cat. 30,102, Scraps. (*TAEM* 27:955, 957, 961).

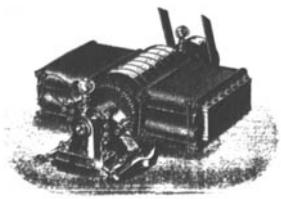
2. Didymium, a name used to describe a mix of rare earth compounds.

3. Unidentified.

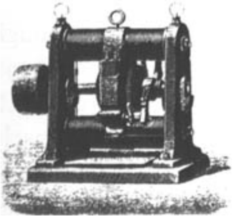
4. This dynamo was designed by Charles Brush and manufactured by the Telegraph Supply Co. of Cleveland. According to Prescott 1878c (423–25), there were two significant features that distinguished the Brush dynamo from other machines. The first of these was the design of the armature and its windings. Unlike many of its contemporaries, the Brush ring armature was grooved, the number of grooves differing according to the purpose for which the machine was designed. The insulated copper wire used for the winding was placed in some of these grooves. This allowed the projecting portions of the armature to revolve very close to the poles of the magnets, thus utilizing more of the magnets' inductive force. Other, empty grooves exposed more of the armature surface to the air, more readily dissipating the heat developed in operation. The second design difference involved the manner of connecting the armature coils to the commutator so as to prevent those not in contact from "affording a path to divert the current generated in the active sections" (Prescott 1878c, 425). The Franklin Institute committee on dynamos had recommended the smaller Brush machine as "ad-

The Charles Brush dynamo design marketed in 1878.





A Siemens/von Hefner-Alteneck dynamo from this period.



A Gramme dynamo from this time.

mirably adapted to the production of intense currents, and [it] has the advantage of being made to furnish currents of widely varying electromotive force" (Prescott 1879, 472). They were also impressed by the ease with which it could be maintained and repaired.

5. This dynamo was manufactured by the Siemens brothers' firms in Germany and England. Werner Siemens devised the first significant improvement in the design of generator armatures in 1857, when he introduced the shuttle armature to replace the disk armatures used in most machines to that time. Ten years later, he also coined the term dynamo-electric machine (later shortened to dynamo) for self-exciting electric generators. In a dynamo, the turning of the armature between the poles of the machine's electromagnet induces a small current in the armature coils. In a positive feedback loop, this current circulates through the field electromagnets, increasing the magnetic field in which the armature turns, increasing the induced current, increasing the magnetic field, and so on. This process continues until the core of the electromagnet is magnetically saturated and the dynamo reaches its full output. Werner's brother William, head of the London firm Siemens Bros., also conducted important researches on the efficiency of dynamo machines and contributed to the development of the Siemens design. The Siemens dynamo was further improved with the development of the drum armature introduced in 1873 by Friedrich von Hefner-Alteneck, chief engineer at the factory of the German firm Siemens and Halske. This armature was found to be highly efficient and became the basis for most modern designs. King 1962c, 369–79; Thompson 1886, 152–56; Thompson 1902, 11, 13–15.

6. Frenchman Zénobe Gramme developed a ring-armature dynamo in 1870 that became the first commercially successful machine and the most widely used by mid-1878. At that time it was considered the most efficient of all dynamos. King 1962c, 379–91; Thompson 1886, 115–18.

7. Unidentified.

8. Doc. 1401.

-1490-

From Grosvenor Lowrey

Tarrytown Oct 10th 1878[a]

My Dear Edison:

Mr Banker has been ill for two days this week and Mr Twombly's occupation and my own engagements have prevented us from coming together. But I have fixed Saturday as a day for meeting to organize a company and pay in the first $30 000 subscription. If I need you on that day I will telegraph you. If you need money send over a messenger, first telegraphing the amount which you will require.

Mr Carr[1] and Mr Depew called on me a few days since. I told them I thought we were not yet ready to entertain proposals for the foreign patents. That it was your design to perfect the light with all the appurtenances here and when that was done you would be ready to name a price for foreign countries.

They seemed entirely satisfied with this, especially as I assured them that they should have fair notice when we were ready and an opportunity to compete with others.

I should like to have a word from you from time to time letting me know how you progress.

Are the foreign patents applied for? Does Mr Serrel look after all these things for you.

Our friends Banker, Edson and Twombly appear quite content with their respective interests. I think nature has formed Mr Twombly to want a little more always, but with this not uncommon defect I am disposed to like him and find good in him.

With the English patents I think we can get money enough not only to set you up forever but to enable you at once if you desire to build and formally endow a working laboratory such as the world needs and has never seen. I should like immensely to see your name given to a place of that sort, which while conducted as nearly as possible on self supporting principles would give a fair opportunity for indigent but ingenious men to have their ideas exploited or exploded as the case might be. Do not you think that might be made a very useful institution. I presume it would be very difficult to arrange so as to suit every-body and perhaps the notion is only whimsical Very truly yours

G. P. Lowrey

LS, NjWOE, DF (*TAEM* 18:33). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"187" preprinted.

1. Possibly Col. Lewis Carr, whom Stockton Griffin telegraphed about arranging a visit to Menlo Park on 8 October and who tried to arrange an appointment with Griffin in New York at the beginning of November. Griffin to Carr, 8 Oct. 1878; Carr to Griffin, 1 Nov. 1878; both DF (*TAEM* 16:201, 368).

-1491-

Technical Note: Electric Lighting

[Menlo Park,] Oct 10 78

Electric Light
Experiment[1]

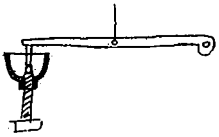
1 Fix the Mercury guage and Air Pump[2a]

2 Arrange a piece of sheet platina ¼ wide and very thin ¹⁄₅₀₀₀ in the glass bulb. with proper bindpost for large wire that we may try the effects of a partial or whole vacuum on radiation from the spiral[b] ⟨O.K.⟩[c]

2 ~~Make 2 large cells consisting of~~ Make 2 platina strips ⅛ wide one & the other ¼ wide both same length & having same resistance on Bradley strap 4[3] with large C and H cell[4] One foil being twice as thin as other arrange the 4 C H cells to heat either to redness but not to incandescence These foils to be without regulators and arranged so that glass tubes can be placed over them, which tubes are air tight at top and ground on bottom so that there is no lea~~a~~kage ~~at bot~~ of air good solid connections required ⟨OK started⟩[5d]

The idea is to ascertain if we do not gain ~~by~~ increased light by increased surface~~d~~ without alteration of resistance and also to ascertain if the radiation nullifies the effect of increased surface

(3) Make 2 lamps without regulators same as above with ¼ inch foils, very thin, one coiled in cylindrical form and the other straight the edges of cylinder not lapping but butted with smallest crack possible[a] ⟨OK started⟩[6d]



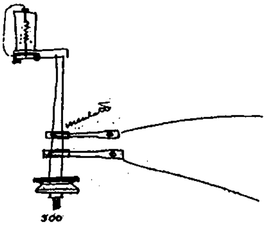
"Old-style" glycerine lamp regulator.

(4) Piece of Platina ¼ in wide to fit double pillar machine rolled if possible 1/10000 inch thick and set in machine.[a]

(5) On one of the old style lamp regulators I want a platina point on lever ⅜ long and on the screw a brass cup containing Mercury in which I place two or three drops of glycerine ⟨OK⟩[7d]

(6) ~~Make~~ With one of the machines made with ⅛ inch foil very thin arranged with a standard candle to see the p. c. of loss with thick and thin tubes of glass over it, the idea being that while glass does not obstruct light in the same ratio as radiant heat hence there may be a gain in amount of light by employing thicker bulbs ~~Arra~~

( ) Arrange on a vertical revolving shaft at 300 per min. a lamp one of old style spirals with regulator securely clamped to the shaft with two ~~heavy~~ rings & heavy[c] connection springs for conveying the current to lamp; idea being to increase quantity of light & diminishing its intensity the spiral must describe a 2 in[ch] circle.[8a]



Old-regulator lamp to revolve on shaft.

Make two induction coils of No 3 primary ~~and~~ 2 layers; and No 8 Secondary 8 layers cores 3 inch diameter 12 inch long cast iron, also cast iron backs placed on bases with bindposts for heavy wires—[9]

T A Edison Chas Batchelor
J Kruesi M. N. Force
Wm Carman G E Carman

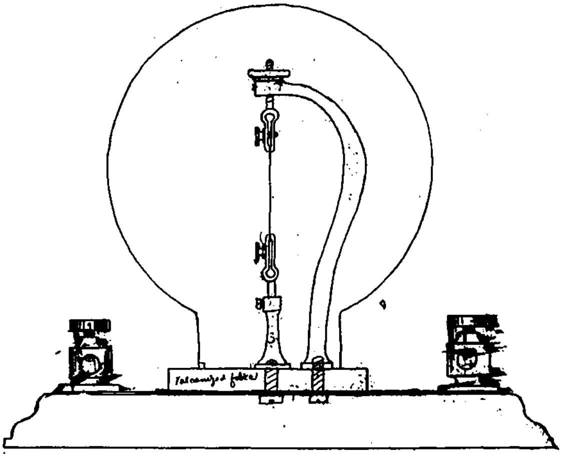
X, NjWOE, Lab., Vol. 16:126, 127, 125 (*TAEM* 4:582–83). Written by Charles Batchelor; document multiply signed and dated. [a]Followed by centered horizontal line. [b]Followed by centered horizontal double line. [c]Written by Batchelor, underlined twice. [d]Written by Batchelor. [e]Interlined above.

1. These notes were copied by Batchelor into a notebook that was later disbound; possibly the missing Experimental Researches Vol. 3 (see *TAEM* 3:277). The copy was made on 22 October and titled "E. 'Light' Experiments to be tried" (Vol. 16:154–55, 177, Lab. [*TAEM* 4:604–6, 622]). They are probably copies of Edison's original notes, which are no longer extant (see Doc. 1543 n. 2).

2. Edison acquired the vacuum pump in January 1875 and had used it in September 1877 for his first incandescent lamp experiments. PN-75-01-05, Accts. (*TAEM* 20:31); *TAEB* 3:547 n. 2.

3. This refers to resistance coil No. 4, a strip of sheet copper, that was used with the Bradley galvanometer to measure the resistance of a conductor. Bradley 1872, 8.

4. Probably the large capacity bichromate of potash batteries made by Condit, Hanson & Van Winkle which Edison had used during his 1877 electric light experiments. See App. 2.



Experimental lamp for thin foil burners.

5. On 23 October, Batchelor gave John Kruesi instructions to make these two lamps and provided a sketch to guide him. Vol. 16:157, Lab. (*TAEM* 4:608).

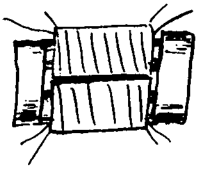
6. On 23 October, Batchelor gave Kruesi instructions to make these lamps (NS-78-005, Lab. [*TAEM* 7:841]). On 3 November, he annotated his 22 October version of this note (see note 1 above) with the comment: "Apparently great difference—coiled-one gives most light. More noticeable on the little Weston machine. The coiled-one measured .07 ohms and the flat one .11 ohms."

7. On 27 October, Batchelor gave Kruesi a sketch and instructions for making this lamp. The same sketch appeared in the 22 October version of this note (see note 1). Vol. 16:167, Lab. (*TAEM* 4:616).

8. On 27 October, Batchelor gave Kruesi a sketch and instructions for making this lamp. He indicated that the lamp should "revolve on a

shaft 1 inch out of centre upright and carry connnections to it by springs (heavy) one (the top) collar insulated & connected to regulator lever— Put this up on table upstairs and set running from shaft underneath." Vol. 16:168, Lab. (*TAEM* 4:616).

9. In his 22 October version of this note (see note 1), Batchelor provided a drawing and indicated, "We decide to make this in this manner. Cores with closed armatures at each end."



Experimental induction coil drawn by Charles Batchelor.

-1492-

From George Prescott

New York, October 11, 1878[a]

Friend Edison

We are about to order an additional lot of telephone receivers, but before doing so would like to know what progress you are making with your new receiver. If you are likely to have it out soon it would be better for us to wait for it, or to order a small lot to cover our immediate wants.

My new chapter on Electric Light is nearly completed. If you wish me to say anything about your work in this direction let me know what, as soon as you can, because I want to finish the chapter, and electrotype it before going on to your experiments in telephonic matters etc.[1]

I ordered your material as requested and sent you cuts of tasimeter which I presume you duly received.[2]

Shall I assign half of my quadruplex patent to you, according to agreement of August 19, 1874, or shall I assign the whole of it to the Company. I will do as you wish.[3]

Dr Nicholson[4] was here yesterday, and says he will show who invented the quadruplex first when he gets before the Patent Office.[5] Yours truly

Geo. B. Prescott

ALS, NjWOE, DF (*TAEM* 16:221). Letterhead of Western Union Telegraph Co., George Prescott, Electrician. [a]"New York," and "187" preprinted.

1. On 13 November, Prescott wrote again to indicate that he would send Edison "the closing pages of my new chapter on electric light in a few days, and would be glad to have you carefully look over what I have said about your investigations, and such alterations or corrections as you desire to make I shall insert with pleasure. Should you desire to have your invention described at any future time I will keep the pages of the book unbound, and insert your matter in a separate chapter." Prescott apparently sent this chaper on 19 November and Edison returned it the following day. Prescott to TAE, 13 and 19 Nov. 1878, DF (*TAEM* 17:240; 16:450).

This appeared as Chapter 14 in Prescott 1879. It followed the chapter from Prescott 1878c on electric lighting and preceded a new chapter on "Edison's Recent Telephonic and Acoustic Inventions." As in the first electric light chapter, most of the discussion concerned arc lighting and generators, but there was some discussion of incandescent lighting that included a notice of Edison's British Patent 4,226, filed 23 October 1878. Discussing Edison's work, Prescott noted his claim to have developed a method of preventing the wire from fusing

> by so applying a small bar that it will expand the instant the wire reaches within a few degrees of the fusing point, and intercept the flow of the current through the wire sufficiently to prevent fusing.
>
> This automatic arrangement secures, it is said, an even temperature in the wire or thin strip of platinum, and consequently a steady glow of pure light. If this is done economically, and the practical limit of the subdivision is sufficiently extended, it is obvious that a marked advance has been made in artificial illumination. Actual trial, however, must determine whether the action of the automatic bar regulator will do all that is claimed for it. [Prescott 1879, 507–8]

Prescott also distinguished Edison's incandescent light regulator from those of Moses Farmer and William Siemens by noting that "in both of the latter it is the current which is regulated, while in the former it is the temperature of the incandescent substance, each lamp being entirely independent of the strength of current above a certain amount, and each also independent of the other" (p. 508).

2. Six tasimeter illustrations appeared in a section titled "The Micro-Tasimeter" in the chapter on "Edison's Recent Telephonic and Acoustic Inventions" in Prescott 1879 (551–58).

3. Prescott assigned half of his U.S. Patent 190,898 to Edison. Prescott to TAE, 17 Oct. 1878; patent assignment, 16 Oct. 1878; both DF (*TAEM* 19:557–58).

4. Dr. Henry C. Nicholson (b. 1824) was a Kenton County, Ky., physician whose interest in electricity led him to make experiments on telegraphy. As early as 1847 he had experimented with a printing telegraph using funds provided by American telegraph entrepreneur Henry O'Rielly. He conceived a multiple telegraph around 1867 and began experiments along this line in 1870. In 1871 and again in 1873 he communicated his ideas to Western Union president William Orton and company electrician George Prescott. Nicholson also demonstrated a system at the Cincinnati Exposition in 1873. Nicholson's testimony, *Nicholson v. Edison.*

5. After reading an account of Edison's and Prescott's work on quadruplex telegraphy in the 15 July 1874 issue of the *Journal of the Telegraph,* Nicholson applied for a patent. He filed his application on 14 October 1874; Edison had filed his on 1 September (Doc. 472). Action on the applications was suspended in view of a probable interference on 31 December 1874 (see *TAEB* 3:379 n. 4). Nicholson believed that Edison and Prescott had adopted ideas communicated in his letters to Western Union, and this became the basis of his claims in the patent interference. The proceedings were delayed by other Patent Office and court actions; it officially began in 1878, the case was not resolved until 1885, and Edison's patent on the core of the quadruplex was not finally

granted until 1892. To protect its rights to quadruplex telegraphy, Western Union had entered into negotiations with Nicholson in January 1875 for control of his invention, concluding an agreement on 12 February 1875. Nicholson's testimony, *Nicholson v. Edison;* Commissioner of Patents to TAE, 16 May 1892, Pat. App. 480,567; Orton to Anson Stager, 23 Jan. and 3 and 9 Feb. 1875, LBO 14:145–49, 171–77, 189–92; Nicholson to Western Union, 16 Dec. 1889, C. L. Buckingham Correspondence File, Box 12, WU Coll.

-1493-

From Hilborne Roosevelt

New York Oct 11 1878[a]

My dear Edison

I am sorry not to have been able to explain the state of the different casses—[1b] I have nearly fixed the Toy business as you see but Russell will not deal with the Phono Co but only with me but is willing for me to arrange with[b] the Phono Co myself and I propose for[b] them to operate it having my half interest or the profits arising therefrom— In the matter of our own contract I have made the alterations we spoke of which I hope will meet your views. You see I put in the Exhibition royalty at the same time to close that up fairly to you— I think I can arrang with Russell on the basis I send— I am very anxious[b] to restore peace in our camp and increase the value of our stock &c— Yours truly

Hilborne L Roosevelt.

I enclose two letters[b] for you to send me after copying in your letterbook, if they are all right—[2] please[b] send at once as there has been much delay with the Toys already HLR

ALS, NjWOE, DF (*TAEM* 19:130). Letterhead of Hilbourne Roosevelt. [a]"New York" and "187" preprinted. [b]Obscured overwritten letters.

[1] Roosevelt is apparently referring to proposed changes in Edison's agreement with the Edison Speaking Phonograph Co. See Doc. 1487 n. 3.

[2] This postscript was probably written the following day. One of the enclosures was Roosevelt's version of his agreement with Edison regarding the toy phonograph contract (draft dated 12 Oct. 1878, DF [*TAEM* 19:131]). This was copied by Edison with changes (Doc. 1499). The other enclosure may be similar to the copy made by Stockton Griffin of an Edison letter to Roosevelt, dated 14 October, regarding proposed changes in Edison's agreement of 30 January (Doc. 1190). This letter indicated that Edison would release the parties to that agreement from their obligation to raise $50,000 within one year of the contract as long as they retained $100,000 capital stock in the treasury in order to carry on the business of the company. In return they would release Edison from any obligation to repay $8,000 if a standard machine was not developed within a year of the contract. Edison would

also be guaranteed twenty percent of the phonograph exhibition receipts. It is not known if this letter was sent (DF [*TAEM* 19:133]).

-1494-

From Grosvenor Lowrey

New York, Oct 12th 1878[a]

My dear Edison

Please be at my office at 2 o'clock on Monday—[1] At that I expect to be ready to place $30,000 at your service for developing the light. At that time I will have the contract which I propose ready—[2] I have drawn it hastily & enclose you a copy[3] to be examined by you before we meet— I think on the whole you should see me & bring back the paper at twelve o'clock, and I can then have it re-written before 2 o'clock at which time I will fix a meeting to organize the Company and complete everything—[4] I got in very late this afternoon & found Mr Griffin just going— He assures me that you do not need the $1240, for bills this afternoon & that Monday will do— If you needed it I would, although it is three o'clock, send out & get the greenbacks— I could give you a check but that would do you no good so late[5]

Another bid for the foreign patents has just come to me from the largest Banking House here— I told them that the longest pole would knock the persimmon, & I explained to them that they must compete with Carr, Depew and all others fairly—

The right way is to perfect the thing here and then—we shall see— I don't dare tell you how much I propose to ask down[b], besides retaining royalties, interest &c Yrs tly

G. P. Lowrey

ALS, NjWOE, DF (*TAEM* 18:36). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted. [b]Interlined above.

[1] That is, Oct. 14. Lowrey's firm, Porter, Lowrey, Soren, & Stone, was located in Drexel, Morgan & Co.'s building at 3 Broad St. (where it meets Wall Street), which would soon become the address of the Edison Electric Light Co.

[2] Lowrey probably refers to Doc. 1576, Edison's 15 November agreement with the Edison Electric Light Co.

[3] Not found.

[4] The Edison Electric Light Co. was incorporated on 16 October to "own, manufacture, operate and license the use of various apparatus used in producing light, heat or power by electricity." The thirteen incorporators included Edison, several members of Lowrey's law firm, Tracy Edson, James Banker, Norvin Green, Robert Cutting, Jr., Egisto

Fabbri, and Nathan Miller. The capital stock was set at $300,000. Articles of Incorporation, DF (*TAEM* 18:38).

An accounting of money received and expended by Lowrey on "Electric Light Matter" indicates that he received $4,000 from Drexel, Morgan & Co. on 12 October; $1,000 from Fabbri & Chauncey, $4,200 from Edson, $1,400 from Banker, $2,600 from Cutting, and $5,000 from Miller on 14 October; and $1,800 from Green on 18 October. This constituted two-thirds of the $30,000 to be paid Edison, with the rest of the money probably contributed by the members of Lowrey's law firm. Edison Electric Light Co. Statement Book, Accts. (*TAEM* 88:427); on Fabbri and the firm of Fabbri & Chauncey, see Doc. 1504 n. 4.

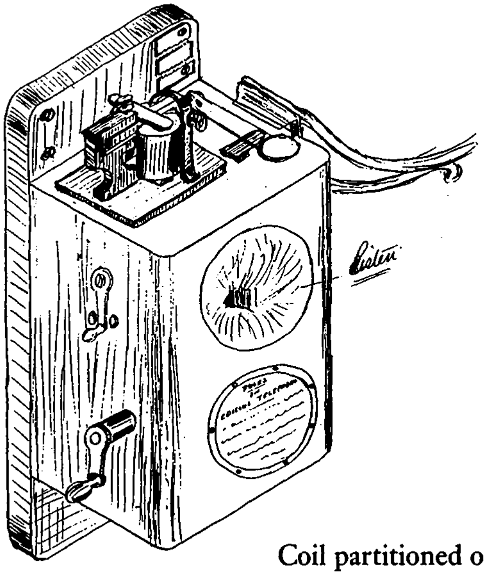
5. On 7 October, Lemuel Serrell had written Edison that he needed an additional $245 for electric light patents. At the bottom of this letter Edison listed this and other expenses amounting to $1,240 and asked Griffin to get the money from Lowrey (DF [*TAEM* 18:772]). On Monday, 14 October, Lowrey paid out this amount in the form of four checks; $245 to Serrell for the patent expenses, $750 to Wallace & Sons for the new dynamo, $117 to the jeweller Rother for the purchase of iridium, and $128 for the purchase of chemicals and other materials (Edison Electric Light Co. Statement Book, Accts. [*TAEM* 88:427]).

-1495-

Technical Note: Telephony

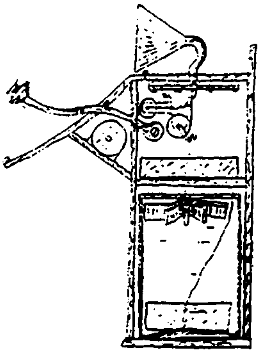
[Menlo Park,] Oct 13th 1878

Edisons New Telephone Receiver Bracket for Same[1]



Coil partitioned off on inside

T A Edison	Chas Batchelor
Chas. P. Edison	M N Force
J Kruesi	G E. Carman



X, NjWOE, Lab., Vol. 18:35 (*TAEM* 4:1070). Written by Batchelor.

1. Text is "Transmitter" and "Listen." Charles Edison began designing telephone wall brackets on 7 October. Over the next few days he proposed several alternative designs for brackets, including some that were similar to the Phelps shelf-bracket (see Doc. 1394). In most of these drawings the transmitter was placed on an extension arm rather than being placed in the cabinet. Charley initially showed a listening tube for the receiver as in the Partrick & Carter telephones (see Docs. 1355 and 1388), but on 10 October, probably to take advantage of the electromotograph receiver's loud-speaking quality, he proposed replacing the listening tube with a horn. Drawings of 13 October also show a horn rather than a listening tube. A measured drawing suggests that a unit like the 10 October design was actually made. Vol. 18:23–27, 30–33, 35–37; NS-78-011; all Lab. (*TAEM* 4:1061–69, 1071–72; 7:930).

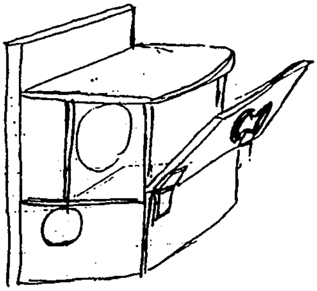
-1496-

Equipment Specification: Telephony

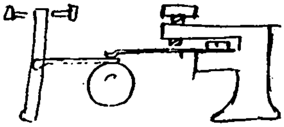
[Menlo Park, c. October 13, 1878][1]

Mr Kruesi

Will you start Moffatt[2] on this box. You will see that the front is hinged That holds the transmitter I will be there soon



Will you also sketch out for Hense[3] a chalk holder for the Motograph like this



Make the chalks so that they can take them off and put another something same as the one I have drawn for the other one only not so wide

B[atchelor] TAE

J Kruesi M N Force

X, NjWOE, Lab., Vol. 18:47 (*TAEM* 4:1081). Written by Charles Batchelor.

1. Kruesi and Force signed Kruesi's note: "Electro motograph receiver previous to Oct 21st 1878." What may be a measured drawing of this design, labeled "Edison's Carbo-Chalk Telephone," is dated 13 October (Vol. 18:39, Lab. [*TAEM* 4:1075]). The design appears to be intended to ensure that users properly switched between transmitter and receiver. The front of the box containing the transmitter apparently had to be swung down in order to hear the receiver and then swung back up to speak. Another design, dated 17 October and labeled "Carbo-Chalk Telephone," also appears to have been intended to overcome the switching problem. It was made by George Jackson during the last week of October (Vol. 18:42–44, Lab. [*TAEM* 4:1077–78]; time sheet, DF [*TAEM* 17:767]). The problem of switching is apparent in other designs from around this date. On 14 October, for example, Charles Edison drew several arrangements for automatic switches on one of which Batchelor noted that users "wont always put tube up & will take it down before they call" (Vol. 18:40–41, Lab. [*TAEM* 4:1076]).

2. Charles Moffat joined the staff at the end of September and did carpentry and other work around the laboratory. His name appears as Moffat in the 1880 census, as Morfitt on time sheets, and as Moffett in Jehl 1937–41, 688. His time sheets indicate that he worked on telephone boxes from 18 October through 1 November (U.S. Bureau of the Census 1970, roll 790; DF [*TAEM* 17:731, 741, 749, 759, 768]). For other telephone box arrangements made during October see Vol. 18:46, 48, 121, Lab. (*TAEM* 4:1080, 1082, 1151).

3. Rudolph Hense joined the staff on 2 October. He was apparently a machinist and worked on electric light and telephone experiments. His time sheets indicate that he worked on electromotographs throughout the month of October. DF (*TAEM* 17:729, 738, 747, 756, 766).

-1497-

To George Gouraud

Menlo Park N.J. Oct 14. 78[1]

My Dear Gouraud

Rec'd Adams Cable dispatch tonight about Bell people putting on injunction on our receivers with magnet.[2] I cannot see how his patent can be maintained because the instrument as shown in his patent is not the one he uses, the one in the patent being inoperative.

However it is perhaps best that Bells patent should be sustained because if left open to the public it might damage us: The new receiver removes all question of patent rights in any country. I have several here in operation but am waiting to see if there are any defects before sending to you— The moment I am satisfied on this point they will go forward— The new receiver is such an enormous advance in telegraphy that you will be astonished— Batchelor last night heard whispering when 15 feet distant from the receiver. Ordinary conversation comes out about as loud as originally spoken, and but one cell of callaud battery is required— In fact with the carbon transmitter and this receiver we have control of Telephony for the future, so be careful.

Electric Light. You know I telegraphed you that I had put you in with some strong parties here on light—[3] So you will be counted in but I can make no arrangements as I am committed to parties here. In this country W. H. Vanderbilt and friends have taken it advancing $50,000 cash to experiment with and giving me ½ of the stock of the Co besides paying a royalty of $30 000 yearly.[4] I am having fine success with the experiments— Am putting in a 50 H. P. engine and lot of electric machines for experimenting—[5] British patent was sent last week.[6]

Private. Parties after the light in England are J. S. Morgan,[7]—Reed[8] the English naval constructor in connection here with Cauncy Depew and Col Carr, also Emil Erlanger[9] Paris (Banker) who cabled— This information is private— Please understand that in any arrangement I make, you are to be in because I consider you as my representative there.

Have rec'd no papers as yet about Telephones— Central System here is a grand success— Very Truly

T. A. Edison G[riffin]

L (letterpress copy), NjWOE, Lbk. 3:408 (*TAEM* 28:841). Written by Stockton Griffin.

1. A draft, written by Edison, is in DF (*TAEM* 16:237).

2. On 12 October, Adams cabled: "Bell company secured an injunction on me and manufacturers. must meet promptly forward all usefull documents." DF (*TAEM* 19:939).

3. Doc. 1461.

4. For the actual terms see Doc. 1576.

5. Edison had begun to request pricing and other information about commercial generators in late September. By mid-October, he had received catalogs and price lists from Condit, Hanson & Van Winkle, suppliers of Weston dynamos (see Doc. 1508); the Telegraph Supply Co., suppliers of Brush dynamos; Arnoux & Hochhausen; and Siemens Bros. of London. Theodore Puskas also sent Edison a price list from the Alliance Machine Co. and made inquiries among other Paris electrical manufacturers. Edison's growing interest in generators was described by a *New York Herald* reporter who had visited Menlo Park on 11 October. During the visit, Stockton Griffin had shown him the small Wallace generator and explained that "Edison has just purchased a new one . . . which gives much more power, and in a few days we will have a fifty-horse power engine to work it, as we don't get power enough with the present one." Griffin indicated that although "Edison has as yet given but little attention" to the subject of generators, he believed that the "cost can by an improved generator [be] reduced to a much smaller figure." Arnoux & Hochhausen to TAE, 10 Oct. 1878; Telegraph Sup-

ply Co. to TAE, 10 Oct. 1878; Siemens Bros. to TAE, 16 Oct. 1878; Puskas to TAE, 25 Oct. 1878; all DF (*TAEM* 17:943, 945, 952, 996); "Edison's Electric Light," *New York Herald,* 12 Oct. 1878, Cat. 1240, item 949, Batchelor (*TAEM* 94:375).

6. British Patent 4,226 was filed 23 October 1878.

7. International banker Junius Morgan, the father of John Pierpont Morgan, was patriarch of the Morgan banking dynasty. He headed the London firm J. S. Morgan & Co. *DAB,* s.v. "Morgan, Junius Spencer"; Carosso 1987, chaps. 1–4.

8. Naval architect and constructor Edward Reed. *DNB,* s.v. "Reed, Sir Edward James."

9. On 5 October, Edison received a letter from the New York banking firm of Plock & Co. regarding "Our friend Baron Erlanger of the firm of Emile Erlanger & Co, Bankers, of Paris & London" who had sent a telegram asking them to "see Edison ask him communicate with us concerning his electric light improvements." On the back of this letter, Edison's secretary, Stockton Griffin, wrote "called at Plocks [October] 7th told him Puskas had sole charge— see him before he commits himself." DF (*TAEM* 18:135); Wilson 1879, 1163; see also Doc. 1480 n. 1.

-1498-

To Theodore Puskas

Menlo Park N.J. Oct 14. 78[1]

My Dear Puskas

Money $1900 received by Serrell Saturday.[2] Patents go forward next Thursday.[3] It will be necessary to take two, if not three sets of[a] patents— The first set will contain the germ principle with apparatus that is somewhat imperfect— I cannot delay the patents to perfect the system because once the principle secured I am safe from the effect of publicity— The second set of patents will have to be obtained when the apparatus has reached a stage where several hundred are shown at once in operation and perhaps a final set, but it is possible that only two sets will be necessary. The first set will cost from 12 to $1500.

The arrangement with Vanderbilt is closed up and they have paid in their money—

No one but you~~rself~~ and I have anything to do with the light on the Continent. Emil Erlanger the Paris banker cabled house[b] here to secure light and they[c] came here to me. I referred them to you. My impression is that I can make my system a great success so do not commit yourself without submitting terms to me— Very Truly

T. A. Edison G[riffin]

L, HuBPo. Written by Stockton Griffin. [a]"sets of" added in margin. [b]Interlined above. [c]Added in margin.

1. Edison's draft of this letter is in DF (*TAEM* 18:143) and a letterbook copy is in Lbk. 3:410 (*TAEM* 28:843).

2. Puskas had cabled Edison about this on 9 October. After a telegraph exchange with Serrell, Edison replied the same day that Serrell had not yet received the money. DF (*TAEM* 16:201–3).

3. That is, electric-light patent applications for the continent of Europe, including France, Belgium, Germany, Austria, Italy, Spain, Sweden, and Russia. On 16 October, Lemuel Serrell telegraphed Edison that he wanted to see him regarding electric light matters. Three days later, Edison asked him when "will those foreign papers be ready to sign" to which Serrell replied "Ready Wednesday." On 22 October, Edison asked Serrell if the papers would be ready for the next day's steamer as it was "very important that some of them go as Scientific American is going to publish" (on this point see Doc. 1554 n. 2). The applications were apparently sent on Thursday, October 24, with the necessary powers of attorney. Serrell to TAE, 16, 19, 22, and 23 Oct. 1878; TAE to Serrell, 19 and 22 Oct. 1878; Serrell's bills to Puskas, 8 Nov. 1878; all DF (*TAEM* 18:774–77, 797–98); see also Doc. 1550.

-1499-

To Hilborne Roosevelt

[Menlo Park,] Oct 14 [187]8[a]

My Dear Mr Rosevelt.

You know that Painter and Johnson were the parties who first dealt with me on the Phonograph Matter[b] and I am in duty bound to ask them if they are satisfied that I should make changes in the contract as proposed.[1] For myself I do not see but that it is all right and fair to all but still I should like to submit the revised contract to both Painter & Johnson before doing anything in the matter.

Regarding the Toy contract that is another matter, because I am not under obligations to them in this respect, and I see no reason why you should not personally buy Harris out. But of course if the Phonograph Co claim that the small machine of Harris is not a toy then I have no right to say to you that you may pay Russell ten cents on each Neither have I anything to do with the amount you pay Harris, because that is a private matter between you and him.[2]I enclose you a letter somewhat changed to see if it will satisfy you and accomplish the object you have in hand. If not I will try and alter it as far as I can with justice to myself. Yours

Thomas A Edison

ENCLOSURE[3c]

Menlo Park NJ Oct 14, 78[a]

Hilborne L Roosevelt Dear Sir

In the matter of the Toy contract I am willing you should take one half interest with Mr O Russell on the following conditions. You must furnish the necessary capital and take the business management and Mr Russell must assist you as far as possible. There must be no clashing between yourselves and the phonograph Company. I will waive the matter of the payment of $6000 annually as a minimum sum for royalty for two years from the date hereof in consideration of your paying me twenty per cent royalty on the selling price of the toys instead of ten per cent, but at the expiration of the two years the $6000 clause shall again become operative but the royalty shall be reduced to ten per cent, the above to be put in legal shape. Mr Russell is to allow you to take in partners if you so require. The experiments on toys must be paid by yourself[4] Very Truly

ALS (letterpress copy), NjWOE, Lbk. 3:404–5, 407 (*TAEM* 28:837–38, 840). [a]Circled "C" written above. [b]Obscured overwritten letter. [c]Enclosure is L (copy) written by Stockton Griffin.

1. This apparently refers to Edison's 14 October letter to Roosevelt discussed in Doc. 1493 n. 2.

2. In the enclosure below, Edison changed Roosevelt's draft (see Doc. 1493 n. 2) by removing the terms under which Roosevelt would buy out Harris.

3. Another copy of the enclosure, written by Edison, is in DF (*TAEM* 19:132).

4. On 16 October, Russell and Charles Harris dissolved their partnership in the toy company. The following day, Roosevelt and Russell first tried unsuccessfully to meet with Edison to finalize arrangements for Roosevelt to take his place. After failing to meet, Roosevelt telegraphed Edison on 25 October, "Will your majesty make an appointment for Russell and myself." Finally, on 5 November the three men met and signed two additional agreements that waived the annual payment to Edison and changed the terms of the royalty due him, as set out in this letter. They also provided that Roosevelt could join Russell in the toy phonograph contract and allowed him to "associate with him as partners the Edison Speaking Phonograph Company." Roosevelt to TAE, 17, 24, and 25 Oct. 1878; agreements of 5 Nov. 1878; all DF (*TAEM* 19:138, 142; 51:768–69).

-1500-

From Edward Hampson

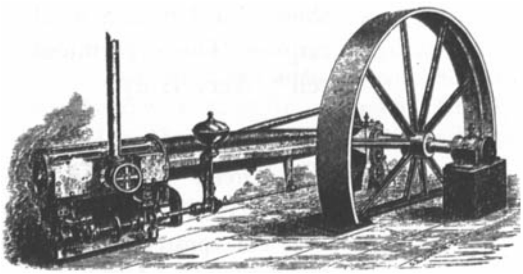
New York, Oct 15 1878[a]

Dear Sir:

Please do me the favor not to mention the price at which I sold you the Brown Engine, this will be to your interest, as well as mine, in case you wish to dispose of it— $2500 is as low a price as we care to make for this size:[1] The man I wrote to about your Hydraulic Press, wants to know how much pressure you want, and the nature of your work, says he can't tell what you want without more information— The plan for your Boiler & Engine House is well along, and expect to call on you with it in a day or two—[2] I will call on you again or send some one to see you about the other Pump— I have some nickel plated shafting would like to have you see— I have written to the mason & will see Mr Kinney—[3] Please call when you come to N.Y. Yrs very truly

E. P. Hampson.[4]

ALS, NjWOE, DF (*TAEM* 18:480). Letterhead of Edward P. Hampson. [a]"New York," and "187" preprinted.



Steam engine made by C. H. Brown & Co.

1. This was apparently an eighty-horsepower steam engine. Edison had begun making inquiries about steam engines at the beginning of October. On 9 October, William Wallace responded by recommending the engine of C. H. Brown & Co. of Fitchburg, Mass., and the following day Edward Hampson, a New York engineer and agent for Brown & Co., sent Edison a price quote of $1,600 for a fifty-horsepower engine. Other responses came from George Corliss of the Corliss Steam Engine Co., Wheelock's Steam Engine Works, and the Buckeye Engine Co., which also submitted a bid. Edison subsequently agreed to have the Buckeye Engine Co. install an eighty-horsepower at their "own expense in order to make a competitive trial or exhibition with the engine which I am putting up." They would then be free to remove it if he decided not to buy it. The Brown engine was shipped to Edison from Boston where it had been exhibited at the Boston Fair and arrived on 15 November; the Buckeye engine arrived at the end of the month. Corliss to TAE, 3 Oct. 1878; George Gibson to TAE, 7 Oct. 1878; Wallace to TAE, 9 Oct. 1878; Hampson to Stockton Griffin, 10 Oct. 1878; Corliss Engine Co. to TAE, 10 Oct. 1878; Wheelock's Steam Engine Works to TAE, 11 Oct. 1878; Buckeye Engine Co. to TAE, 12, 14, 17 Oct. and 30 Nov. 1878; Hampson to TAE, 9 and 14 Nov. 1878; TAE to Hampson, 14 Nov. 1878; Charles Batchelor to Buckeye Engine Co., 30 Nov. 1878; all DF (*TAEM* 18:460–68, 471, 477, 482, 522–23, 525–26, 556–57); Batchelor to George Caldwell, 23 Oct. 1878; TAE to Buckeye Engine Co., 29 Oct. 1878; Lbk. 3:445, 458 (*TAEM* 28:874, 884).

2. The boiler and engine house were built at one end of a new brick machine shop. The entire structure was designed by Babcock & Wilcox, who also supplied the boiler. The Babcock and Wilcox elevation and cross-section drawings for the building are in Pretzer 1989, 54–55. Bab-

cock & Wilcox specification for boiler, 12 Oct. 1878; Babcock & Wilcox to TAE, 4 Nov. 1878; both DF (*TAEM* 18:572, 513).

3. Unidentified.

4. According to his letterhead, Edward Hampson sold "steam engines and boilers, wood and iron working machinery, saw mills, grain mills, hoisting engines, etc." His business was located at 91 Liberty St. in New York City.

-1501-

From Norman Lockyer

[London,] Octr 15 [1878]

My dear Edison,

I was so sorry to miss you after your return to N.Y. Why did you not come to the century?[1] One may elapse before we meet unless you are very good.

Thanks for the cuts for Nature[2] but I want you to let Nature have the first say about your things & not almost the last! What in thunder is this new gas arrangement of yours? I have just bought some gas shares but I am prepared to go in for one universal bust & explosion in Nature if you will only let us talk about it in time.

Have not received the tasimeter[3]

The Museum here has not received your first phonograph[4]

We are both gaping for the fulfillment of your promise.

Now please send me all your novelties while they are red hot likewise a photograph of you like the one you gave the crafty Fox. Believe me Ever faithfully yours

J Norman Lockyer

ALS, NjWOE, DF (*TAEM* 16:239).

1. On the afternoon of 28 August, Edwin Fox had telegraphed Edison that Lockyer was sailing for London the next morning and wanted to see Edison at the Century Club where he was spending the evening as Henry Draper's guest. Griffin promptly relayed this message to Edison, who was at the Edison Speaking Phonograph Co. offices. Later that evening, however, Edison replied to Fox, "Say to Lockyer very sorry last train had left ere telegram received." DF (*TAEM* 15:1086–87).

New York's Sketch Club, a serious artistic and literary society, had expanded and reconstituted itself in 1846 as the Century Club. According to its charter, the Century was open to persons wishing to cultivate "a taste for Letters and the Arts and social enjoyment." Many of its founders were noted authors or artists, but the Century's rapidly growing membership was more inclined to social enjoyment. By this time it was known as a place of genteel leisure for New York's professional and independently wealthy men. Bender 1987, 123, 139–40.

2. Lockyer is probably referring to illustrations for the article "Edison's Inventions" that appeared in the 24 October issue (18:674–76). The cuts, from various *Scientific American* articles, showed the harmonic

(tuning fork) engine, carbon rheostat, phonomotor, and megaphone.

3. Edison had apparently promised Lockyer a tasimeter. Just prior to the eclipse, Lockyer had sent an enthusiastic report of the instrument to *Nature* (18:401–2):

> One of the many points of interest here, to me, has been the observatory in which Mr. Edison has been experimenting on his tasimeter. It is truly a very wonderful instrument, and from the observations made last night on the heat of Arcturus, it is quite possible that he may succeed in his expectations. For its extreme delicacy I can personally vouch. The instrument, however, is so young, that doubtless there are many pitfalls to be discovered. Mr. Edison, however, is no unwary experimenter.

4. It would be two years before Edison actually sent his first phonograph to the Patent Office Museum in South Kensington, London (now the Science Museum). See *TAEB* 3:649.

-1502-

From George Gouraud

LONDON 16 Octr 1878.[a]

T. A. Edison Esq
Telephones

Everything is going on satisfactorily and I shall forward you in a few days the papers in the case of the first organisation namely "The Railway Speaking-Telephone Company of Great Britain (Edisons Patent)" outline form prospectus of which I enclose.[1]

The object of my first transaction as reported to you by Cable and approved was mainly with the idea of securing the entire time and services of a very useful man who makes the first advance himself and under my direction "pulls the wires." I took the course I did with respect to submitting to you the proposition by Cable for the reason that the only way I could get him to decide at once was by saying that I would join him in the purchase on that basis, he therefore does not know that you share with me the Stock I am to have. The plan accomplished the purpose. He does not know nor does any one else the basis of my contract with you nor is it necessary that they should. What I do with them I do on the merits of the basis known to them: what I do with you is nobody's business but yours and mine.

I propose to get several times the sum named as advanced Royalties from the Company formed and you will also receive a large proportion of the shares of the Company as well.

Now, I will tell you generally what my ideas are as to the best means of making the most of the splendid material in hand namely,—that we shall not sell out the whole thing to, nor place the whole matter in the hands of, any one set of people however good they may be but that we shall organise all over the Country in all the large Towns in Great Britain a separate Company called "The Speaking Telephone Company of"—Edinburgh, Glasgow, Manchester, Sheffield & so forth—having a local Board in each place consisting of the best men in the place ~~and divide it~~ as on outlined in[b] form Enclosed.

I propose for the general basis of these Companies something like the following

1. That the Patentees shall grant exclusive Licenses,[c] he to receive one-fourth (if I can make it so—one-fifth at least) of the price charged by the Company as Royalties or Sale leaving to each Company the rates to be determined

2. The Company to pay an advance of as much as I can get in each case on account of Royalties all the way from £1000 to £20,000 depending upon the comparative estimated values of the districts licensed.

3 That you are to have perpetual representation on the Board of each Company so long as your interest in its business is dependent upon Royalties or profits. I mean until—as it is possible might be the case—your entire interest were bought out.

I propose that I shall be that Director but whoever he may be he shall have the power to appear by proxy at all meetings of either an entire Board or an Executive Committee thereof.

There are some novel features about this plan but they have the merit of common sense and the plan of separate Companies in any such undertaking is, I believe, in this Country quite unknown; but several friends of mine whose opinions I esteem most highly confirm my impression that it is the very best we can adopt.

I propose to have everything perfected in the way of the organisation down to the minutest detail so that whenever we are ready to exhibit the thing in a certain locality we may take advantage of the local excitement and gratuitous advertising which we are bound to get from the Press and be ready to at once accommodate a few of the people who are sure to want to go in; and, striking whilst the iron is hot there will be nothing to do but receive their cheques and furnish to them their Shares. I should propose to offer as available for local subscription as a rule only a proportion of the total Share issue beginning with a half and raising the amount to accommodate any demand beyond that.

I have had numerous offers already to organise Companies in different places if I would place the matter in the hand of the proposers but I have decided that one organisation being perfected it is a mere matter of machinery to grind out as many more as may be needed and by these means we will save parting with interest that we would have to give to others to do work that we can get done at a small expense ourselves. This plan you will observe practically gives me control over our joint interests—yours and mine—of each organisation and the system of local Companies will enable us to get into, not only the Board but as Shareholders of the Telephone Company a vast number of prominent[d] people who could not possibly be expected to either take Shares or be Directors in a single London Company. The one exception to the exclusive privilege in any single geographical[c] district to any one Company will be "The Railway Speaking-Telephone Company of Great Britain" whose business will be confined exclusively to Railway Companies which run everywhere and to which, in the end we may be obliged to sell the privilege outright as a means of getting the most money since experience proves that they are apt to prefer the payment of rather round sums to have done with internal administrations and to avoid the necessity of requisitions and accounts. But you will see that this exception will not materially affect an extensive business to each local Company.

Unless I am greatly mistaken you will derive a most satisfactory income from your share in th~~i~~ese Compan~~y~~ies and which it shall be my special pride as well as my own best interest to make as large as possible

Bell Telephone Co's Injunction

We all agree that we had better not put out any Telephones commercially in any way until we get the new Receiver since you declare that that will place the question of infringement beyond all possibility Meanwhile we really lose no time since we shall go on with a sort of private demonstration of the power of the instrument and the selection of our shareholders and Directors, but you will of course appreciate the great importance of losing no time in placing us in that impregnable position which the new Receiver promises to afford

Your Telephone generally

I have established a little Telephone Exchange of my own account as per Plan enclosed,[2] connecting my office with several offices in the City with which I am always in constant communication I show the Telephone from here and I may say that without exception everybody who has thus far seen it—and only the choice few have been invited—pronounce it, as of course you will not be surprised to hear—all that we can ask with respect to its superiority to Bell's—in a word the gist of the comparison is simply that one is practicable and the other is not; and no one asks anything better than yours so that if your new Receiver is as your Cable informs me four times as loud—well, unless it jars upon the brain I suppose it will not do any harm but what you have given is good enough, still I suppose you cannot help following[c] it up to get the existing to what you believe to be the possible or what to you is synonymous with perfect.

We none of us like the tube instrument the Receivers being so far away there was a certain resonance from the action of otherwise imperceptible waves of the atmosphere striking against the tubes themselves. We like the bracket form infinitely better and are having a lot made with a table adapted to the size of English Telegraph forms and the Call Bell underneath so that there is nothing visible but the Transmitter and Receiver. We put an extra arm to the Transmitter bracket so that it may be used when sitting upon a chair or by giants or dwarfs, children &c. We will also have a bracket upon the wall in which to hang the receiver should it be desired to sit long either for conversation or reading through the Telephone making it unnecessary to hold anything. We shall go ahead with this form of transmitter and use the present receiver for those made in advance of the new and independent Receiver.

I enclose copy of the manner in which I met[c] the first attack of Bell which I think will meet with your approval and will show them that we mean business.[3]

What I meant in my Telegram about sending Transmitters only was that Adams for some reason decided to make the Receivers here

Electric Light

If I had had my wits about me when your Telegram came announcing your discovery in this connection I might have made you a clean million as it played the very devil with Stocks all over the country. They have since rallied somewhat partly due to circulation by the Bulls of reports that your discovery is all a hoax; notwithstanding Adams is deluged by letters and visits of enquiry. I enclose sample of two letters selected from this morning's mail with the circular form of reply adopted in one case and special reply in the other.[4] I also enclose card which will probably[c] appear in to-morrow's papers from Adams. By the way I am conducting all this correspondence in Adams's name but from the address of my office where he has a private room and every convenience.

Now, my dear fellow, I would express my very high appreciation of the compliment you pay me and your kindness as well in proposing to place in my hands this further invention and one, which, if all is true that is credited to it should be found the most money-making thing that you could possibly have produced and I need only assure you that you shall have, as usual, my best attention. I regret that you should have found it necessary to combine with me in England somebody in New York as you intimate however "~~bright~~ strong a[c] party" it may be. With regard to the Continent and your sentiment for Puskas I[c] will abstain from comment from motives of delicacy.[5c] I feel it however due to you to state ~~that~~ one circumstance concerning him in which I have felt your honor to be at stake and the course which I pursued in connection with it.

It has been impossible for me to proceed in the matter of the preparation of the necessary papers between yourself and the proposed Compan~~y~~ies without more information concerning the Patents Deeds &c than I had; and, inasmuch as you advised me that the Telephone Patents were included in the Phonograph patents and that I should obtain a copy of Nottage's contract as a basis I undertook to do so, and finding the only practicable means to be a letter from Puskas to the Solicitors who drew it instructing them to furnish me a copy. I applied to him for it and after considerable hesitation and some delay he gave me a letter requesting them to allow me to read it and take a copy if I desired. This letter I gave to my Solicitors who made several visits and applications and quite contrary to the custom in the profession they were unable to obtain it, being pressed for the reason they finally gave it to be that supposing me to be interested with you they objected upon the ground that Puskas your agent in this matter had never paid the costs which had been repeatedly demanded of him. Upon receiving this information I immediately instructed my solicitor to state that I was connected with you and represented your inventions in this country, and that I would personally guarantee the prompt payment of all the charges in question incurred in your behalf. Now my dear fellow you must draw your own inferences from this statement which is more evidence corroborative of more than one rumour I have heard about the gentlemen in question.

I feel perfectly certain that this invention can be worked to more profit from London as its centre than by any other possible means as all the large Continental Banking interests have Branches or Resident Partners, or intimate connections here in London and if your Light is what we are led to infer it will be the biggest thing in the world for making money with. I am always at your command and if you like to make my interest in this subject include the Continent either as a whole or as a part you will of course do so.

Other letters referred to as enclosed I have not time to get copied, will go forward by next mail.

ENCLOSURE[f]

The Speaking-Telephone Company of

Directors
______ a Swell
______ an M.P
______ a Railway Director
______ a manufacturer
______ a merchant
______ a Banker
Mr Butcher[6]—& myself—
Bankers
The best firm of Local[c] Bankers
Solicitors
The best firm of local Solicitors
Brokers
The best firm of local Brokers & also a good firm of London Brokers as London[d] Brokers to the Coy.
Consulting Engineers
Thomas A Edison & The most prominent Electrician in the District
Telephone Engineer
James Adams

ENCLOSURE[g]

London, 187[h]

Edison's Electric Light
To the Editor of[7]
Sir:

May I ask so much of your valuable space as to allow me to take this means of replying to the communications which are pouring in upon me from all quarters, as well as personal applications to an extent quite beyond my powers to meet with personal interviews.

Nothing can at present be said upon the subject of Edison's Electric light further than has already been made known through the medium of the press, except that every effort is being made to push forward the securing of the patents so soon as this is accomplished, not a moments time will be lost in exhibiting the process in this country.—

Meanwhile no contracts can be entered into for the sale of, or licenses under the patents; but the numerous applications already received as well as any that may be hereafter received will be duly noted and the writers communicated with whenever that part of the business is ready to proceed with.

It may perhaps be of value to add that the reports circulating in some quarters to the effect that "the whole thing is a hoax" must have emenated from interested parties as there is no doubt whatever that Mr Edison has made the "alleged" discovery in question.

It shall be my very great pleasure Mr Editor to extend to yourself together with the other Editors of the leading journals the first invitation to witness the practical operations of "The Edison Electric light." Yours faithfully

Assistant to T. A. Edison.

L, NjWOE, DF (*TAEM* 16:243). Note form of George Gouraud; note form is electric pen copy. [a]"LONDON" and "1878." preprinted. [b]Interlined above by Gouraud. [c]Obscured overwritten letters. [d]Interlined above. [e]"strong a" interlined above by Gouraud. [f]Enclosure is D, in same hand as letter. [g]Enclosure is D (electric-pen copy), in an unknown hand on letterhead of Edison's Carbon Telephone. [h]"London," and "187" preprinted.

1. The enclosure is probably the printed prospectus in DF (*TAEM* 19:998). No other papers for this company have been found.

2. Not found.

3. Not found.

4. Only one of the letters is known; it is from the law firm of Wilson, Bristows, and Carpmael. Gouraud's "special reply" survives, as does a copy of a general response letter and a short electric pen circular response letter. These are in DF (*TAEM* 16:256–60).

5. Gouraud wrote Edison on 18 October criticizing Puskas for combining with Bailey on European telephone matters and again on 26 October describing Edward Brewer's poor opinion of Puskas. He concluded the latter letter by commenting that "there must be some fire where there is such a continual smoke." DF (*TAEM* 19:948, 960).

6. Probably William Butcher, subsequently jailed on forgery charges, whose 21 September 1878 agreement Gouraud later charged to be fraudulent. Gouraud to Edward Bouverie, 14 July 1879; TAE agreement with Bouverie, 1 Aug. 1879; Renshaw & Renshaw to Gouraud, 20 Sept. 1879, all DF (*TAEM* 52:616, 648, 800).

7. Two days later the *London Times* published the first three paragraphs of this letter in substantially the same form. It was signed by

James Adams using Gouraud's address at 6 Lombard St., London. "Edison's Electric Light," *London Times,* 18 Oct. 1878, 4.

-1503-

Draft Caveat: Electric Lighting

Menlo Park Oct 16, 1878

Electric Light Caveat No 5[1]

The object of this invention is to subdivide the Electric Light by causing Etc Etc

Fig. 1.

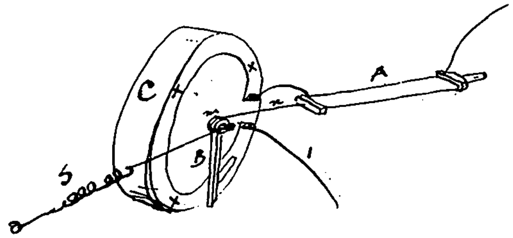


Fig 1 shows a method whereby as the current increases in strength the foil A Expands and rotates the lever B around the disc C by means of the shaft m and string or cord n. The spring s serves to keep the foil A stretched X [-][a] is a flat foil on the face of the chalk disc C, this foil is included in the circuit when A expands the arm B moves to the left and cuts more of the foil X in circuit hence as the current strength increases more foil is thrown in circuit reducing the temperature of A hence A cannot rise in temperature to the melting point

Fig 2

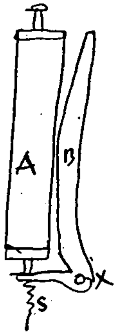


Fig 2 shows a method to decreasing the resistance of the incandescent foil A when its temperature rises hence the temperature cannot rise above a certain degree. Upon the expansion of A the lever B is brought in contact with A and a portion of the circuit passes through B. S. is a spring to keep the foil A stretched

fig 3

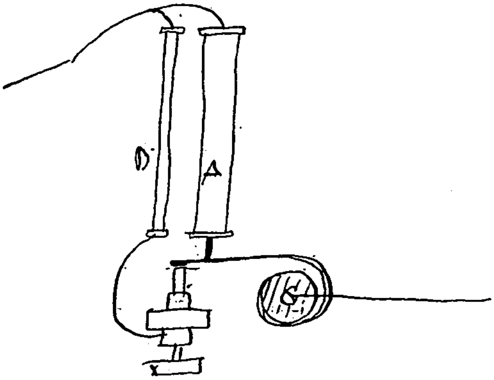


Fig 3 shows the regulation of the temperature of the foil A by ~~stretching~~ short circuiting[b] it. a second but smaller strip B forming a part of the short circuit

fig 4

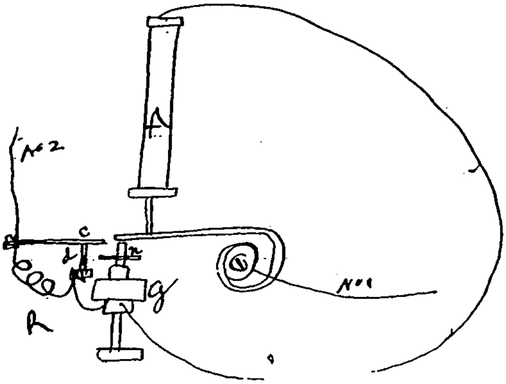


Fig 4 shows the usual short circuiting method with the addition of and extra device for throwing the incandescent conductor of out circuit when it is not to be used & throwing in circuit a resistance equal to it, so as to keep the resistance of the line perfectly constant. C & D are contact points seperated by the disc n upon the upward movement of the screw g—when they are seperated the foil A is cut of circuit & the resistance R thrown in fig. 5[2]

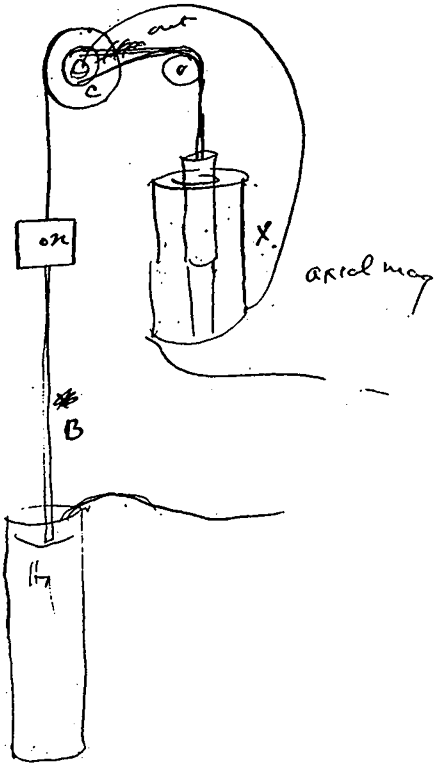


Fig 5 shews a method of throwing more or less foil in circuit by means of an axial magnet. X is the axial magnet C a pulley on which a long strip of foil is wound. n is a weight to keep the foil stretched B is a rod dipping in mercury through which the connection is made. when the current strength increases the core is attracted within the magnet spool to a certain distance & this[c] give rotation to the drum C and the weight n uncoils more foil

fig 6

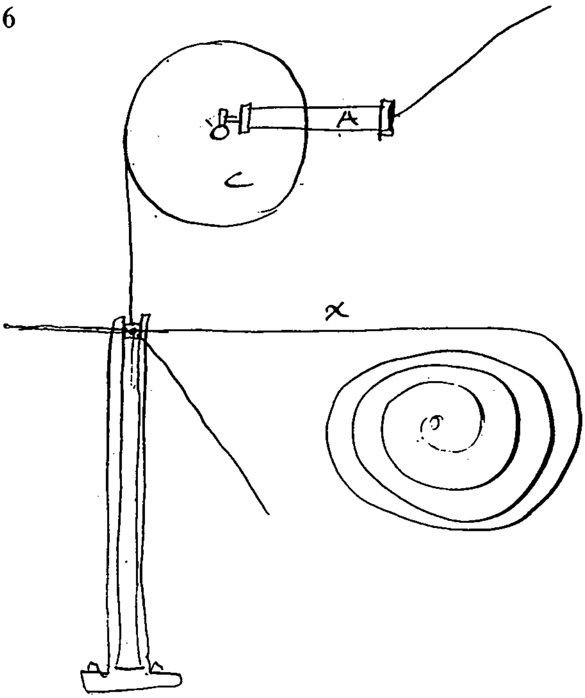


Fig 6 is a similar arrangement a spring X gives the downward motion. C is the drum carrying the foil and a an extra foil whose expansion allows C to rotate and more foils unwinds

fig 7[3]

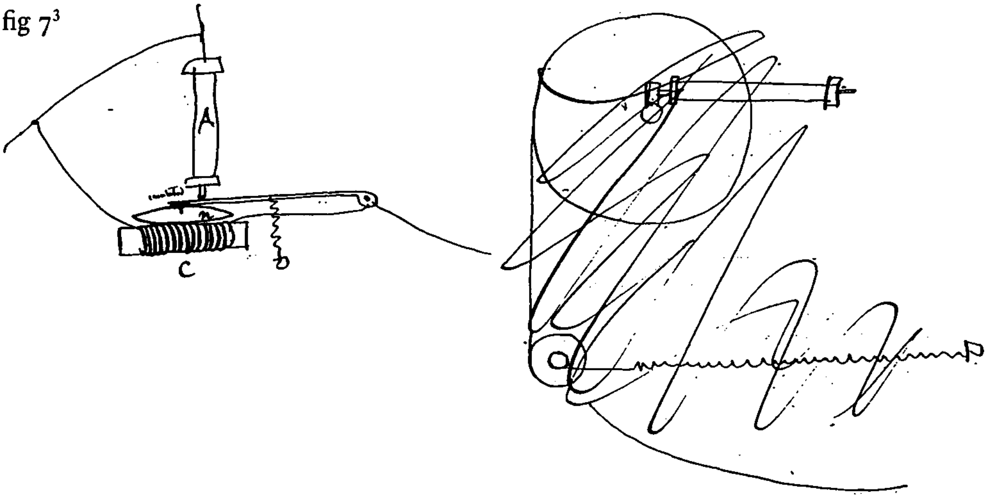


Fig 7 shows a variable short circuit around the incandescent foil A. C is a block on which is wound fine wire a spring n when A expands flattens out and short circuits more or less of the wire on c & thus shortens the shunt around A fig. 8.[4]

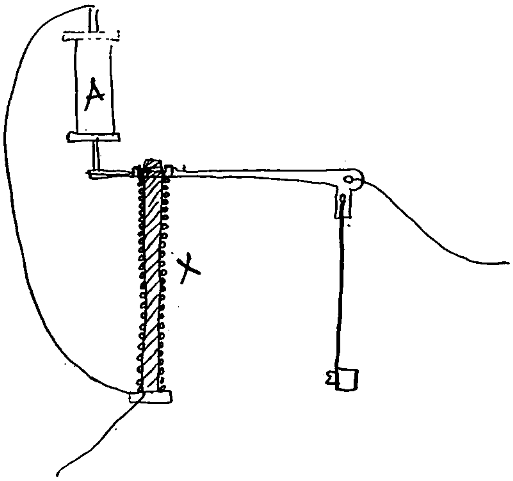


Fig 8 shows a similar device X is a spiral spring which acts as a resistance a downward movement of the lever on the expansion of a brings all the spirals together and forms the short circuit thus preventing any spark

Fig 9[5]

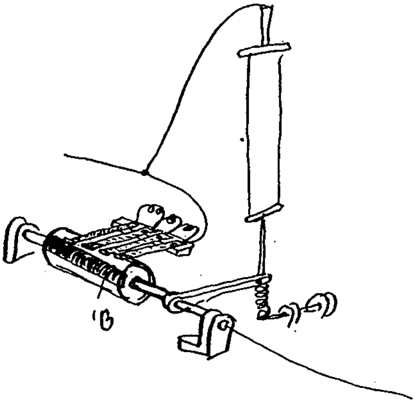


Fig 9 is a similar device the rotation of the cylinder short circuits more or less of the springs upon the metal peices B thus shortening the shunt fig 10.

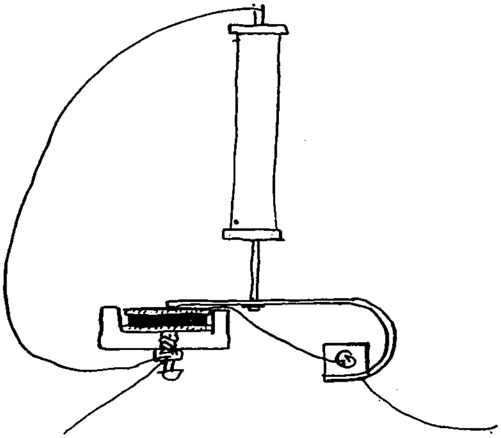


Fig 10 shows a shunt formed by a Carbon button

fig 11[6]

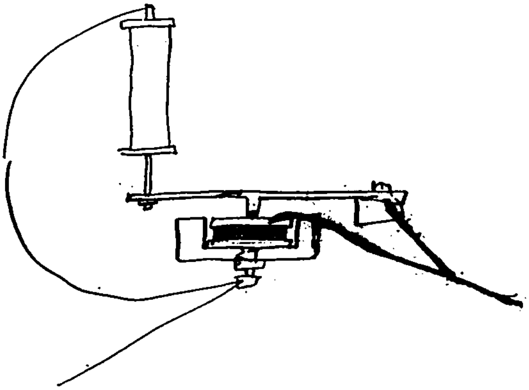


Fig 11 is another modification of the carbon button principle

fig 12

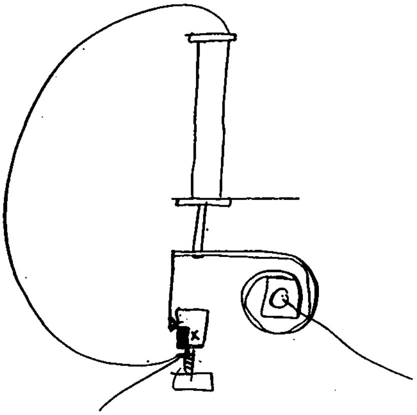


Fig 12 shows a sliding contact Point X being the platina fig 13.

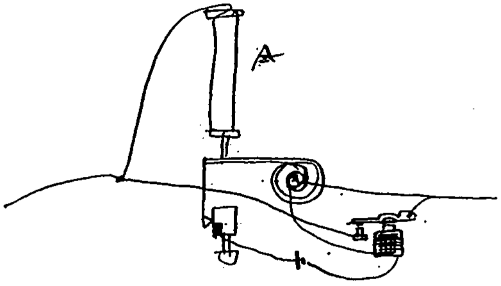


Fig 13 shows the sliding contact point which in this case does not short circuit[c] the foil A but closes a local circuit containing a battery and magnet the lever of the magnet short circuits the foil A

fig 14[7]

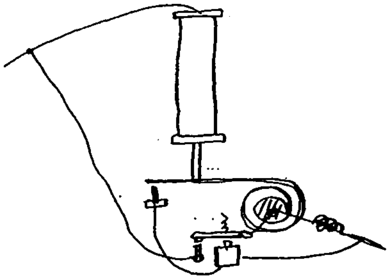


Fig 14 is a similar device but the magnet is worked by a current from a derived circuit

fig 15 [8]

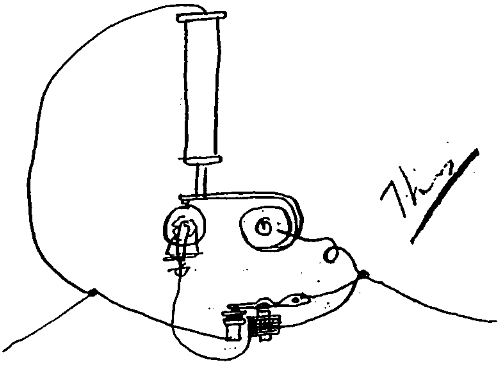


Fig 15 the magnet does not make a platina contact short circuit but one by pressure thus preventing sparks

fig 16

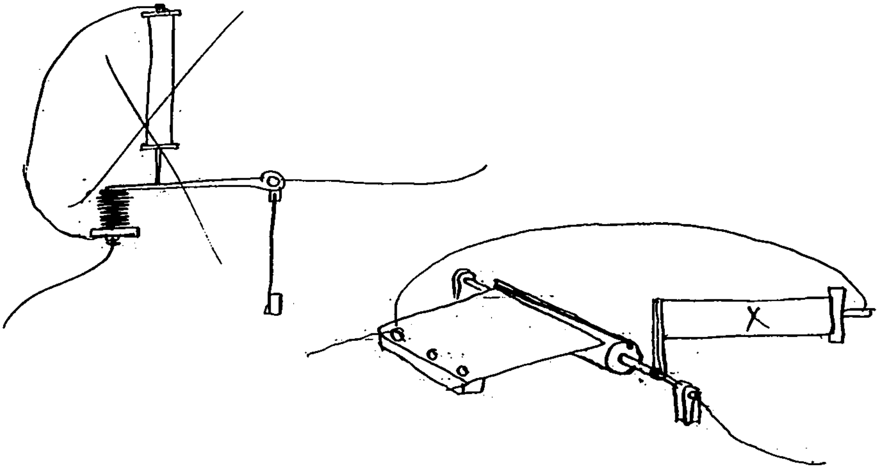


Fig 16 shews a rotating wheel with a peice of Carbon in it more or less of this Carbon is thrown in the shunt as the foil a expands or contracts

fig 17[9]

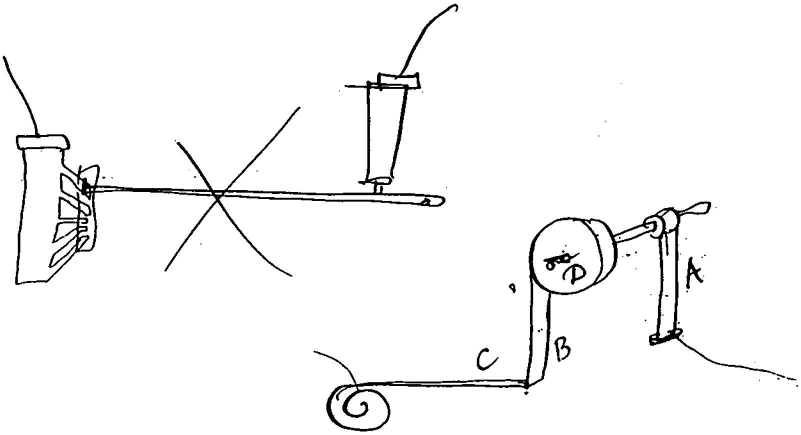


Fig 17 shows a device whereby an increase in the current puts in an increased length of foil A in expanding rotates d and this having a large surface ie^{d} being a larger wheel allow more of the foil B to unfold. C is a spring to keep the foil stretched

fig 18[10]

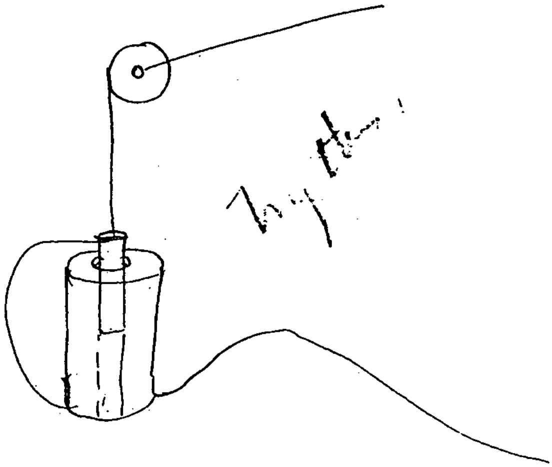


Fig 18 shows an increased length of foil placed in circuit by means of axial magnetism

fig 19[11]

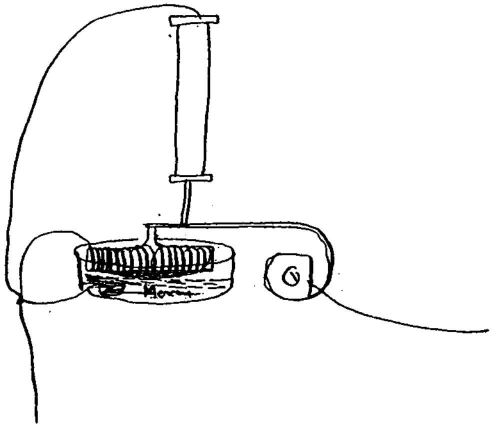


Fig 19 shows a coiled shunt whose resistance is increased or decreased by more or less contact with mercury

fig 20

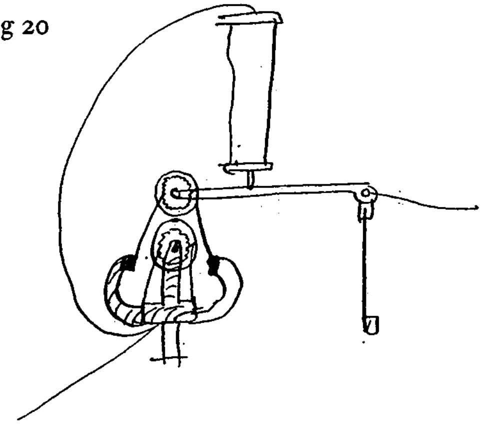


Fig 20 shows two revolving contact wheels to insure clean contact points

fig 21

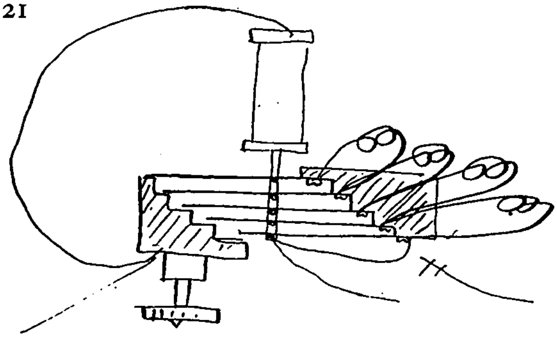


fig 22

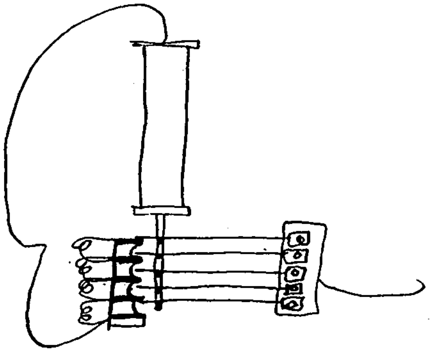


Fig 21 & 22 shows gradually diminishing resistance[c] of shunt by means of several springs arranged so that with a slight expansion of the spiral one spring comes in contact with its point and shortens the shunt and so on

fig 23

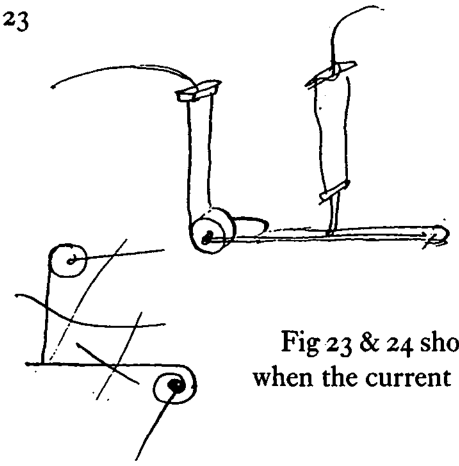


fig 24

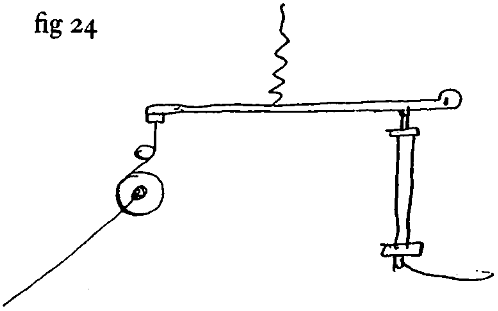


Fig 23 & 24 show devices for giving increased length of foil when the current strength is increased

fig 25

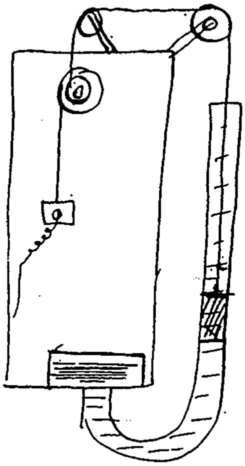


Fig 25 shows is[c] similar to 23 & 24 except the movement of the foil is obtained by mercury

Thomas. A Edison

DfS (copy) and ADS, NjWOE, Lab., Cat. 997:81 and NS-78-005 (*TAEM* 3:392; 7:828). Text written by William Carman, drawings multiply signed (some by Batchelor). [a]Canceled. [b]"short circuiting" interlined above. [c]Obscured overwritten letters. [d]Circled.

1. Figures 1–3, 5–16, and 19–25 of this draft caveat were included in Edison's Caveat 85, filed 25 October 1878 (Edison Caveat 85). Edison's drawings for the draft, all dated 15 October and many witnessed by Batchelor, are in NS-78-005, Lab. (*TAEM* 8:828–36). They have been used in place of the copies made by William Carman.

2. Edison wrote "out" and canceled the horizontal line at top center—representing the cord from the magnet core—and redrew it attached to the underside of the pulley, thereby creating an apparently unworkable design. Text at right is "axial mag."

3. Text is "insulated."

4. Edison also wrote "Try" on this drawing.

5. Edison's drawings also include an unfinished and unnumbered variation of this. NS-78-005, Lab. (*TAEM* 7:828).

6. Edison wrote "~~T~~Expmt" on this drawing.

7. Edison wrote "Try this" on the drawing.

8. Edison wrote "This" on the drawing.

9. Edison wrote "Try this" on the drawing.

10. Edison wrote "Try this" on the drawing.

11. Text is "Mercury."

-1504-

From Grosvenor Lowrey

New York, Oct 17″ 1878[a]

My Dear Edison:

I have received your enclosure from the ex-Mexican Consul.[1]

Decidedly I should think it best to take out patents in Mexico, and in others of the Central and South American States—wherever there is patent law, and to get Government concessions where there is not. You remember that upon Mr Edson's suggestion you consented that these should go into the arrangement with the Edison Electric Light Company, subject however to a different provision as to royalty; that is to say, as I understood it, your royalty for those Southern Countries is not to be counted in the $30 000 to which you are limited for the United States and Canada.

Mr Soren[2] is now going over the contract carefully, and I will have a provision put in fixing a similar limit for South America, say $30,000 for those countries. That, I think will be fair. After a conversation with Mr Banker this morning I think it right to suggest that you should not answer, for the present, any enquiries which may be put to you by parties recently in negotiation with you as to the progress you are making. After reflection it is our opinion that those parties have not been actuated by the most elevated sentiments, and we see no reason why they should be favored with the means of judging whether to come in or not within the fortnight which I gave. The answer which was made to me on the day when we parted, in your presence & in that of Mr Edson and Mr Banker, was such as to make me regret that I had suggested keeping the thing open. I think, therefore, as that gentleman[3] is for the moment out, he is not entitled to have any information as to how you are getting on.

In respect to your letter of the 18th to your Paris Agent I should like to see you, and then we will draft a letter suitable to go to him.[4]

I am fully of opinion that the very best thing you can do is to interest J. S. Morgan & Co, of London, with you directly, so that they will be interested in enhancing the price instead of being interested in reducing it. I have mentioned this to Mr Fabbri,[5] who has again complimented me upon getting to be too much of a Banker; but added, "of course that is the very wisest thing that Mr Edison could do, because then you may be sure that all the money there is in Europe to be got out of this thing will be got." and I will add fairly accounted for.[b]

The rights and interests of Col Goreau and of your Paris Agent, of course, are to be protected. If these gentlemen are intelligent they will at once see that by enlisting the services of such a house as Morgan & Co their own interests will be very greatly enhanced.

I should like to know when you are coming in, and will telegraph to find that out today.[6] Yours Very truly

G. P. Lowrey

LS, NjWOE, DF (*TAEM* 18:152). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted. [b]"and I . . . accounted for" interlined above by Lowrey.

1. Not found.

2. George Soren was one of Lowrey's law partners and an incorporator of the Edison Electric Light Co.

3. Unidentified.

4. It is unclear what Lowrey means by Edison's letter of the 18th, but see Doc. 1505.

5. Egisto Fabbri had become a Drexel, Morgan & Co. partner in 1876. After becoming a partner he stepped down as head of Fabbri & Chauncey, a major New York shipping and commercial firm with which Drexel Morgan did a large business. Carosso 1987, 148, 167–68.

6. No such telegrams have been found.

-1505-

To Theodore Puskas

MENLO PARK, N.J.[a] Oct 17, 1878[1]

Dear Sir

I cabled you on the 15th inst as follows

"Puskas. Paris. Dont commit yourself on light without consulting me." Edison[2]

Since I communicated with you last some friends [of][b] mine in this country have engaged with me for the purpose of developing and perfecting in the highest degree the electric light, and with that in view have provided the requisite capital for that purpose as I have already informed you. By this means I hope before concluding any definite arrangements with any persons in Europe for the use of the light to be able to exhibit precisely what it can do and for that reason I am desirous that nothing should be consummated for the present, or until I have given you definite instructions on the subject. In the meantime my friends Messrs Drexel Morgan & Co of this city (being among the parties who have interested themselves here) have mentioned to me that Mr Harjes[3] of their house in Paris would at the proper time be willing to confer with you in respect to what shall be done with the light in Europe. I shall be glad if you will put yourself in communication with Mr Harjes upon this subject, and meantime do nothing tending to commit either yourself [or][b] me until we have completed entirely our demonstrations of the light here and until [I][b] have given you further instructions. Yours Very Truly

T. A. Edison per Griffin

L (letterpress copy), NjWOE, Lbk. 3:425 (*TAEM* 28:856). Written by Stockton Griffin. [a]Place from Edison's laboratory handstamp; circled "C" written at top. [b]Edge of letterpress copy cut off; text from draft.

1. This letter was drafted by Grosvenor Lowrey following his letter to Edison of the same day (Doc. 1504). The draft is in DF (*TAEM* 18:150).

2. This cable is in DF (*TAEM* 18:145). Puskas answered on 17 October that he would consult Edison (DF [*TAEM* 18:149]).

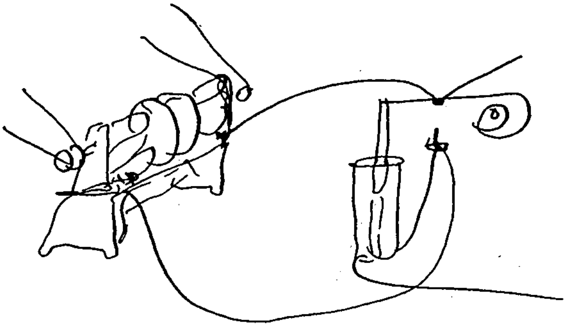
3. John Harjes (b. 1830) was resident managing partner of Drexel, Harjes & Co., the Paris subsidiary of Drexel, Morgan & Co. Carosso 1987, 134.

-1506-

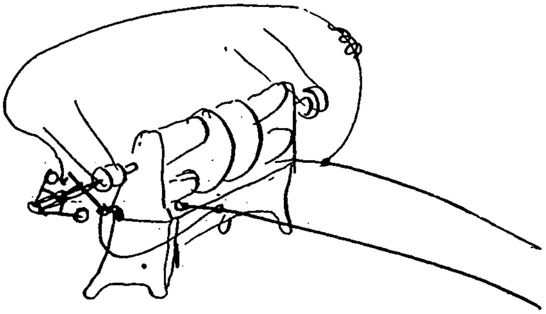
Technical Note: Electric Lighting

Menlo Park, N.J., Oct 17 1878[a]

Caveat No. 6.[1]



regulating the total current.[2]



Regulating the speed of the magneto also its current.[3]

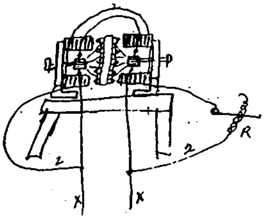
TAE

X, NjWOE, Lab., NS-78-005 (*TAEM* 7:838). Letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted.

1. The previous day Edison had drawn three pages that he labeled "Caveat No. 6" (NS-78-005, Lab. [*TAEM* 7:836–37]). Most of those

drawings are lamp regulators resembling designs in draft Caveat 5 (Doc. 1503); one is a dynamo regulator. On 6 November he labeled three more pages of drawings the same way (Doc. 1556). He never filed any of these designs in a caveat.

2. These regulators (with the drawing from 16 October mentioned in note 1) show Edison's first attempts to govern the output of a dynamo. The sketches show the large Wallace dynamo, which had recently arrived at the laboratory. In this drawing the cylinder at lower right represents an axial magnet (described in Doc. 1503 [fig. 5]) that works against a spring (at upper right, with the dynamo output wire attached) to pull an iron core downward with increasing force as the current through the coil (the dynamo's output current) increases. If the current becomes great enough, the contact points (to the right of the cylinder) will short-circuit the output current (with potentially disastrous results).



Sketches from Edison's testimony.

3. This design shows the main current shunted through a governor attached to the dynamo's shaft (at left). It is related to a design Edison sketched during his testimony in an 1881 patent interference in which a similar shunt runs through the field coils and a variable resistance. Edison said that that sketch and another related one showed experiments done in October or November 1878. Edison's testimony, pp. 55–56; Edison's Exhibit No. 9, both *Keith v. Edison v. Brush* (*TAEM* 46:141–42, 176).

-1507-

From William Barrett

Dublin Oct 19, 1878

Dear Mr Edison

I wrote to you yesterday[1] & today brings your letter of the 7th I am very glad to have your version of the Preece-Hughes affair if you will allow me I will at once publish the principal part of your letter; moreover, though Mr Preece is a personal friend ~~of mine~~ I prefer[a] offending him to the suppression of what is true, and so far as I can judge with Preece's Hughes & your letters before me—you appear to have been wholly justified in the statements you made. I will let Sir Wm Thomson see your letter & write [~~soon~~][b] ~~to~~ him[c] on the question. Lord Rosse[2] whose name is of considerable influence in scientific circles was here yesterday[3] I regret that your letter was not before me then but I will show it to him on his return to town in a few days— I propose incorporating the facts you give me in an article in Nature and coming from an independent source I trust the English & New York papers will see your claim~~s~~ is justified. As to Clerac's resistance tubes I am glad to have your confirmation of my own opinion that no mere variation in pressure—would suffice for Telegraph work— These are obviously afterthoughts just as in my own case after my discovery of——— flames there was an attempt made (by an eminent Scientific man to whom I had shown my early expts after suppressing my name & virtually claiming the discovery for himself) to refer the whole thing to some one else who happened long prior to have made an incidental and forgotten observation remotely related to it. Leaving these matters let me congratulate you on your new triumph. I hope your discoveries are in good hands The Carbon telephone is likely to be a much better speculation to the companies working it than it was for you. Have you tried recording the signals sent— An idea suggested by one of Varleys patents might be useful. A wire in a coil vibrating under the action of the current & its vibrations [revealed][4]—by its movements in front of a chintz with a light behind.

With the Tasimeter I would suggest a cylindrical silvered mirror behind the strip, this gives a line of light falling[d] on the strip— Do you wish these made by an special firm? I suppose it is patented & a royalty might be paid by the makers—I will go to London next week purposely to try some expts with your telephone on a 110 miles wire (Norwich to London) Mr ——— M. P. has lent me for the purpose. I send you a Dublin paper today with a short paragraph I sent them on your Telephone Perhaps something may be got out of the new expts I send you ~~by~~ with[e] this by book post— I will give Adams one of the instruments for you though they are hardly worth sending— I want electro's of some of your things shown in Prescotts book for "Nature" & can they be got to save fresh wood cuts[5] Yrs &c

W F Barrett

L (copy), NjWOE, DF (*TAEM* 16:273). Written by Stockton Griffin. [a]"I prefer" interlined above. [b]Canceled. [c]"~~to~~ him" interlined above. [d]Transcribed as "pulling". [e]Interlined above.

1. In this letter Barrett described some of his experiments with the tasimeter. DF (*TAEM* 16:270).

2. Laurence Parsons, the fourth Earl of Rosse, was an astronomer and later chancellor of Dublin University. *DNB,* s.v. "Parsons, Laurence."

3. In his letter of 18 October, Barrett stated that he and Rosse had experimented with the tasimeter for two hours with imperfect results and that Rosse had indicated that he would "come again when I [Barrett] have more thoroughly mastered the instrument."

4. Apparently unable to read Barrett's writing, Griffin wrote "recorded" above and "reverted" below "revealed" as possible alternatives, enclosing the three words in braces.

5. See Barrett 1878d.

-1508-

From Condit, Hanson & Van Winkle

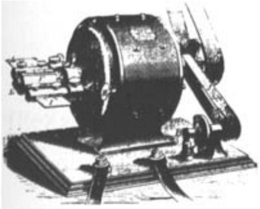
Newark, N.J., Oct. 19 1878[a]

Dr Sir

We shipped you to day N.J. Ex[press] the 12 in machine,[1] this is our usual plating machine[2] and of medium E[lectro]. M[otive]. Force[3] Mr. Weston[4] requests us to write you that in case you prefer one with greater El. M. force we will exchange for this, and that if you require any assistance in adjusting brushes[5] &c beyond directions sent we shall be happy to send some one fr. factory[6] Yours truly

Condit Hanson & Van Winkle[7]

L, NjWOE, DF, (*TAEM* 17:970). Letterhead of Condit, Hanson & Van Winkle. [a]"Newark, N.J.," and "187" preprinted.



Edward Weston's electroplating dynamo.

1. Edison had ordered this machine on 10 October, apparently after obtaining a catalog of the Weston dynamos sold by Condit, Hanson, & Van Winkle. He purchased it for $306.25, a 12½ percent discount of the listed price. TAE to Condit, Hanson & Van Winkle, 10 Oct. and 7 Nov. 1878, Lbk. 3:400, 485 (*TAEM* 28:834, 911); Condit, Hanson & Van Winkle to TAE, 10 Oct. 1878, DF (*TAEM* 17:944).

2. Weston's electro-plating dynamo was 12 inches long. It provided an output of steady direct current in comparatively large amount but not of very high voltage. In a letter of 12 October, Condit, Hanson & Van Winkle indicated that it had a two-inch pulley face and ran at a speed of 800 revolutions per minute. DF (*TAEM* 17:946); Prescott 1884, 658–60; Woodbury 1949, 64; U.S. Pat. 180,082.

3. The term electromotive force had been used with a variety of meanings but had come to refer strictly to voltage (see Prescott 1877, 73, 270; Sabine 1867, 333–41, and Thompson 1888, 15–24). Numerical measures of the electromotive force and other aspects of the Weston plating dynamo have not been found.

4. Edward Weston (1850–1936) was an English-born, Newark-based inventor and manufacturer of electrical technology and instrumentation. Woodbury 1949; *DAB,* s.v. "Weston, Edward."

5. Wire brushes electrically connected the spinning portion of the dynamo with the rest of the circuit. They needed to press as lightly as possible against the moving metal contacts to minimize power loss to friction, yet firmly enough to guarantee good contact with minimal resistance and sparking.

6. It is not known when the dynamo was delivered to Menlo Park nor when it was set up and connected by belt to a steam-powered shaft to run it, but by 13 November the laboratory staff was conducting comparative tests with it and the two dynamos Edison had acquired from William Wallace. See Doc. 1572; Vol. 16:260, Lab. (*TAEM* 4:699).

7. The Newark firm of Condit, Hanson & Van Winkle (Condit & Hanson before mid-1876) sold chemicals and electroplating supplies. Edison had been a customer since 1872. The firm was designated as sole agents for the dynamos produced by the Weston Dynamo Electric Machine Co. (Abraham Van Winkle, president). Condit & Hanson bill of 3 May 1872, DF (*TAEM* 12:851); Condit, Hanson, & Van Winkle to

TAE, 11 July 1876, Scraps. (*TAEM* 27:618); Woodbury 1949, 62–66, 72–74.

-1509-

From Edward Johnson

NY Oct 19 [1878]

My Dr E.

I saw Lowrey and made an appointment with him for middle of next week. Meantime you will no doubt see him and by letting slip a remark indicative of your preference to have the Phono control in Other hands than the Bell Co. you will facilitate my programme He asked me for my opinion of your progress in Electric Light I gave it him in my usual "sattelite" style Yours

Johnson

ALS, NjWOE, DF (*TAEM* 19:141). Letterhead of Edison Speaking Phonograph Co.

-1510-

From Josiah Reiff

[New York, c. October 19, 1878][1]

Dear T.A.

How about the Canada Patents?[2]

J. C Reiff

Would it not have been old fashioned to have put me in as one of the incorporators of the Co here? Why cannot you have me in the company as a Director say on your a/c?

It might help us both—

ALS, NjWOE, DF (*TAEM* 16:283).

[1] Reiff wrote this on the back of a letter from DeWitt Taylor dated 19 October (DF [*TAEM* 16:282]). Taylor, who wrote from New York City, probably sent this letter in the morning mail, as he indicated where he would be that day until 2:30 P.M. Reiff may well have sent Taylor's letter to Edison in the afternoon mail. Lists of the Edison Electric Light Co. incorporators were published in both the 18 October *New York World* and the 20 October *New York Sun* (Cat. 1240, items 952, 963, Batchelor [*TAEM* 94:376, 382]).

[2] Taylor had written Reiff on behalf of a mutual acquaintance named Kimball who was interested in introducing Edison's electric light in Canada. Taylor also expressed interest in acquiring an electric light agency for himself.

-1511-

From James Adams

London Oct 20th/78

T. A Edison

I recd your two letters to day[1] will send by next mail the desired information.[2] I go to Paris on the 22d but will not be able to stay very long as I have got my hands full here, but shall divide my time up between the two places as best I can Puskas was here the other day, and wants to know how soon I can go to Italy, but it will be impossable for me to go for a month yet. Bell people is rather softening than otherways I dont think they will trouble, us just yet. Blakey & Co.[3] is going ahead making our telephones independent of them I think they would rather come to some kind of terms with us than go to law, however it remains to be seen what they will do. The fire department will be the first, to have our telephones in. there wires is mostly underground & very hard wires to work. I could put in any number of them if I only had them. I have got a first rate place in Gouraud's office for Experimenting, it look quite a small laboratory I got in to day 112 fuller Batterys[4] I have had him experimenting on his batterys for some time back, & he says that they will last eight months, or he will charge nothing for them, and very cheap and makes very nice looking boxes two cells in a case. I like the Western Union form better than any I ever seen and they take everyones fancy here. that is the stile I will make in the future, only I put two receivers in place of one. You speak about deprecating Puskas actions I tell you everything I hear how and where from and you can be your own judge expecting to hear from you soon I am yours truly

Jim

Saw the editor of the Journal of the Telegraph and he feels sure that the reason that you did not send him some cuts was because you think that Preece is in some way connected with the paper, he says he once was but not now. he wanted me to ask you if you would be[a] kind enough to send him a cut of yourself.[5] I believe he ~~has~~ has written to you himself. The few tube telephones that I have made I will use them someway out in the country they are good enough for short & quite wires I wish you would send me a good stock of lamp black as early as you can and I wish you would send me a bradly reostate.[6] I am in want of that very bad as I am going about from place to place I would like to have my own mesureing apparatus dont forget to send that

Things could not look up better than at the present time I have no further troubles Perfectly satisfied that I can work any wire in London

ALS, NjWOE, DF (*TAEM* 19:953). [a]Interlined above.

1. Not found.

2. It is not known what information Edison had requested. The next extant letter from Adams is dated 30 October from Paris. In that letter he reported that "there has been no telephone tests made here for the last two months except a few days before I came over, and everthing was busted. at any rate they only could just hear it by talking very loud so they thought telephones had given out. I tried them today and found it so." After testing the telephones, however, he discovered that their poor showing was at the Versailles end on account of iron hooks used to hang the wires there and he arranged for the use of another line. He also told Edison that he had seen Count Du Moncel who "still inclines towards Hughs." DF (*TAEM* 19:962).

3. Probably the firm of Blakey and Emmott, located in Halifax, England. Povey and Earl 1988, 18.

4. A powerful bichromate of potassium cell invented by John and George Fuller (Brit. Pat. 3,339 [1877]). Relatively inexpensive to maintain, untended Fuller cells could stay in good condition for a few months if little used. Steady usage required attention to the cells at intervals of four to six weeks. Edison and his staff had experimented with Fuller cells for the electric pen, which like the telephone was used intermittently. Niaudet 1884, 211–20; Maver 1892, 17–18; *TAEB* 3:201, 220, 225 n. 15, 227 n. 2.

5. The *Journal of the Telegraph* was published in New York; Adams meant the London-based *Telegraphic Journal and Electrical Review*, edited by John Munro. William Preece had helped begin the *Telegraphic Journal* in 1872 and he edited the first few issues. On 24 October, Munro asked Edison to provide a photograph for the *Telegraphic Journal and Electrical Review* to publish in an occasional series of illustrated biographical essays on "our most eminent home and foreign electricians." Munro thanked Edison in November for sending a portrait and stated that "we intend to produce the photo and biography immediately after publicity has been given to the Edison Electric Light." He asked that Edison permit the *Telegraphic Journal* to publish it "in the same number with our detailed and illustrated description of your light" at the same time that American journals printed full details about the light. However, Munro's planned "Edisonian number" did not appear in the next several years. Baker 1976, 107; Munro to TAE, 24 Oct. and 25 Nov. 1878, DF (*TAEM* 17:208, 252).

6. Leverett Bradley, the late Jersey City manufacturer, had developed a rheostat and galvanometer set for making accurate electrical measurements. Bradley 1872.

-1512-

From George Barker

Philadelphia Oct. 20th 1878[a]

My dear Edison:—

The papers you placed in my hands have all been sent to the printers and I shall have some proofs to send you soon.[1]

I am quite surprised at the attitude Morton took the other night in regard to electric illumination.[2] If he hadn't seen your light, he might at least have believed your statements about it. I am waiting to see how astonished he will be when the thing comes out. By the way how much longer before you are to make the thing public? Let me know when the seal of secrecy is removed, please. I notice in the papers of Friday a list of incorporators of an Electric Light Co. with a capital of $300,000. Is this a Company formed for New York state only, or does this Company control the whole thing? I sent a note of introduction to you the other day by a Mr. Davis, a prominent gas man.[3] I was introduced to him by Dr. Genth & dont know him at all, though he seemed a gentlemen & represents a large capital. The gas people seem inclined, at least the more intelligent of them, to take up electric lighting. Has any move been made toward your light in Philadelphia? If there should be, I should like a chance there. My brother-in-law Mr. Thompson of St. Louis at whose house we were, you remember, is Sec. & Treas. of the Laclede Gas Light Co.[4] He writes me to know if he can do anything to secure the right for your new light for Missouri. If there is a chance, I would be glad if you will favor him, if you can as well as not. There seems to be a great panic among the gas people in Europe too. By the way did you see Sir Wm. Thomson's statement "The electric light, if there are a sufficient number of lamps can be produced with equal economy at a great and a small distance."

You know I am depending on you for my lecture of Nov. 14th. I am expecting Bachelor to come with you & to stay with you at my house. Come over Wednesday if you can so that we can experiment all day Thursday. I expect to have two of Wallace's machines, my own Gramme, a Siemens and a Brush machine; so there will be a grand chance to try your new light with the different currents. I would like to have you loan me for the lecture at least twenty burners, as I want to put a dozen on a chandelier on the stage and turn them on and off as you would gas. Then as you suggested a few on stands would be a good thing beside. I expect too, to drive all my machines on the stage with the new Otto gas engine[5] which you saw at Wallace's. I think now I shall have a four horse and a seven horse power engine on the stage. I want to do a good thing and to give the Edison light a fine scientific send off.

If Bachelor is not too busy will you ask him to send me the things I gave him a memorandum of, particularly the automatic apparatus. I have sent my article on the tuning fork method[6] to the printers without having made the experiments I wanted to with that apparatus. How about the phonograph you said you would loan me? I notice you have two or three capital ones lying round your place and rusting. You might just as well let one lie round my place, where I will keep it from rusting and keep it for my own private use. Do send me one if only for a short time. When can you send me one of your new lamps to experiment with on my Gramme machine?

Have you seen Draper since he got back? He got 13 tons of game. He wants you to come & see him some day in N.Y. The Nat. Academy meets in N.Y. Nov. 5. Cordially yrs

Geo. F. Barker.

ALS, NjWOE, DF (*TAEM* 16:286). Letterhead of University of Pennsylvania. [a]"Philadelphia" and "187" preprinted.

1. This refers to Edison's AAAS paper on the tasimeter (Doc. 1401) and another on the sonorous voltameter (Doc. 1382). Both of these appeared in the *American Journal of Arts and Sciences* and the proof pages are in Cat. 1241, item 1074, Batchelor (*TAEM* 94:438).
2. See Doc. 1488 n. 2.
3. On 19 October, Edison received a telegram from L. H. Davis (sent from Riverton, N.J.), who indicated that he wanted to see Edison the following Monday on "important business with introduction from Prof Barker." Edison replied that he would be at Hamilton Twombly's office in the Western Union building at noon that day. The letter of introduction has not been found and it is unknown if they met.
4. James D. Thompson, secretary of the Laclede Gas Light Co., lived on Washington Avenue in a fashionable St. Louis residential district. *Gould's St. Louis Directory* 1878, 916.
5. A four-stroke cycle, horizontal gas engine developed by German engineer Nicolaus Otto in 1876 and manufactured by the firm Otto & Langen. Bryant 1967, 651–57.
6. Barker 1878.

-1513-

From Edwin Fox

New York Oct 20 1878

Friend Edison

I notice with regret that some of the papers envious of your well earned fame are doing all in their power to detract from the same and belittle you. I know that so far as you are personally concerned you don't care what they say but it none the less pains your friends. As one of the latter therefore I speak in the hope that the suggestion I offer may have a tendency to spike their fears. The interview with you in Sundays Sun is of the character that does you harm.[1] It makes you do too much talking. My friendly advice to you is not to talk to any more reporters. Let them write all they please about your inventions, let them if they desire confab with every employee in the laboratory, but keep yourself aloof and reserved. Your works speak ~~fro~~ for[a] themselves. In all that I have written about you I have sought to keep you on a high pedestal. Holding you out to the world as a chewer of tobacco[2] and all such trash as does[b] the Sun in the interview published is really too bad. Knowing your natural reserve and silence about your great works I am all the more pained to see you represented in the character of a person talking ad libitum about them.

Gen Grants great fame is due more to his reserve and silence than to anything else.[3] Every word that you utter for publication should be to accord with your reputation like thunderbolts.

I trust my dear fellow that you will take these few suggestions in the spirit in which I write them. They are the emanations of a friend who is honestly desirous of seeing you mount still higher on the ladder of undying greatness Truly Yours

Ed. M. Fox

P. S. When will you be in town? E.M.F.

ALS, NjWOE, DF (*TAEM* 17:206). [a]Interlined above. [b]Obscured overwritten letters.

1. "Edison's Electric Light," *New York Sun*, 20 Oct. 1878, Cat. 1240, item 963, Batchelor (*TAEM* 94:382).

2. The *Sun* reporter described the following incident:

> Here Mr. Edison dropped his cigar stump from his mouth, and turning to Griffin, asked for some chewing tobacco. The private secretary drew open a drawer and passed out a yellow cake as large as a dinner plate. The Professor tore away a chew, saying: "I'm partly indebted to THE SUN for this tobacco. It printed an article asserting that I chewed poor tobacco. That was so. The Lorillards saw the article, and sent me down a box of the best plug that ever went into a man's mouth. All the workmen have used it, and Griff says there is a marked moral improvement in the men. It seems, however, to have an opposite effect on Griff. You see he has salted away the last cake for his own use."

On 29 August, Lorillard & Sons had written Edison, "We learn from an article published in today's 'Sun' that you are obliged to keep constantly on hand a stock of musty tobacco for the use of malefactors, general depradators, and visiting scientists. Permit us to present you for your own personal use a package of 'gold bars'." DF (*TAEM* 15:1091).

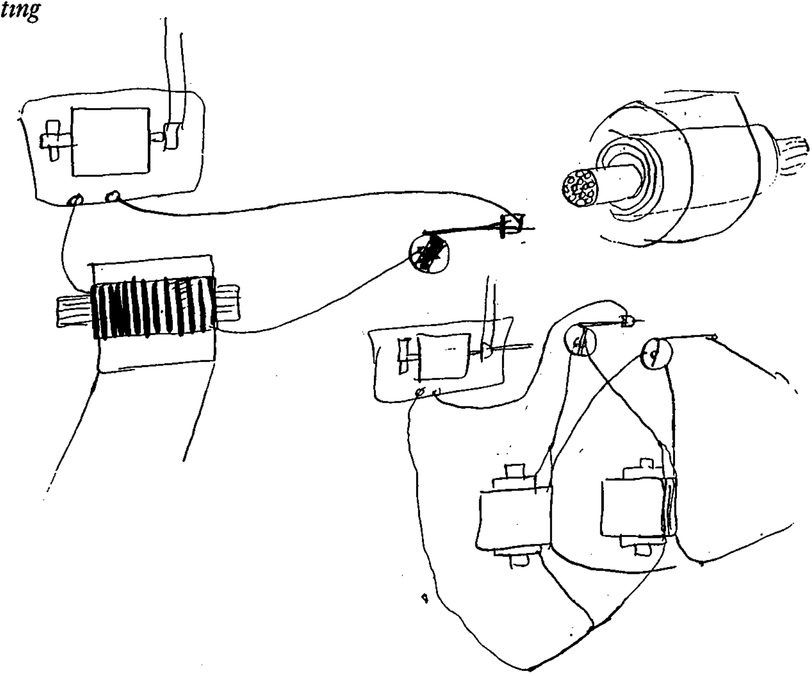
3. Former president and Civil War general Ulysses S. Grant, whose extensive, best-selling memoirs had not yet been written. *DAB*, s.v. "Grant, Ulysses Simpson."

-1514-

[Menlo Park,] Oct 20 1878

Technical Note: Electric Lighting

Electric Light.



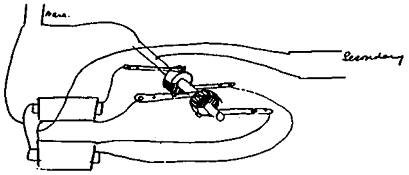
I propose to use two or more induction coils arranged with commutators on a small quantity magneto machine. This commutator throws the current from the magneto first into one primary & thence to the others, without breaking the continuity of the magneto circuit. The same commutator also throws the secondary in circuit of a main wire ~~jus~~ simultaneously with the ~~thr~~ taking off of the primary & so on=[1] I hope by this means to get a current which may be opened and closed without interfering with the magneto machine,[2] also to conveniently obtain any tension required,[3] and to prevent loss of power by dispensing with a great amount of dead magnet wire, weight etc on a magneto machine.

T A Edison	Chas Batchelor
J Kruesi	M. N. Force
Wm Carman	Geo E Carman

X, NjWOE, Lab., Vol. 16:147 (*TAEM* 4:598). Document multiply signed and dated.

1. On 10 October, Edison drew a detailed sketch of two such commutators. Although there is no accompanying descriptive text, they are attached to a "Base" that may be the base of a dynamo. Vol. 16:124, Lab. (*TAEM* 4:581).

Edison's sketch of alternative connections for induction coils and commutators.



2. Keeping a dynamo running evenly while varying the load on its main circuit—for example, turning lights on and off—was a significant problem in electric systems.

3. Edison is proposing to use the induction coils as transformers to change the voltage on the main circuit, which could be done by altering the proportions of the primary and secondary coils.

-1515-

To Grosvenor Lowrey

Menlo Park NJ Oct 21, 1878[a]

Dear Sir

Perhaps you may remember in the matter of the Quadruplex suit a claim of Mr E B. Welch,[1] of Boston to some interest in that invention. His letters and the contract on which he based his claim I think appear in the records of the above named suit.[2] He has been sending me threatening letters, copies of the two last received of which I send you herewith.[3] The experiments in which he claims to be interested were relative to Duplex telegraphy and were not successful. The expenses were all borne by me. Of course you understand the W. U. Co own all of that class of inventions with which my name has been connected. Will you please look into the matter and see if Mr Welch has a valid claim against me and greatly oblige,[4] Very Truly,

Thos A Edison

LS (letterpress copy), NjWOE, Lbk. 3:432 (*TAEM* 28:862). Written by Stockton Griffin. [a]Circled "C" written above.

1. E. Baker Welch had supported many of Edison's telegraph experiments in 1868–69. See *TAEB* 1:71 n. 1; see also Docs. 36, 61, 64–65, 68, 75, 79, and 84.

2. Though Welch's claims were not part of the Quadruplex Case, Josiah Reiff had expressed concern about it during Edison's testimony (Doc. 895; see also Doc. 577). The contract is Doc. 61.

3. Welch's letters of 12 and 19 October (DF [*TAEM* 19:554, 560). Welch had concluded the latter by stating "I have your letters acknowledging the contract—so you cannot deny it now."

4. Welch had first asserted his claim in a letter of 30 May 1878, to which Edison replied on 20 June that he had sold out his interest in the duplex and believed that Welch's contract had no value. The 9 October letter was Welch's next contact with Edison and he again asserted his belief, based on the advice of lawyers, that he was entitled to a half interest in any of Edison's duplex inventions. Edison answered on 12 October, "Where was the consideration. I had to pay [Charles] Williams his whole bill and the thing was a failure a man cannot sell what isnt existing. I have sold out to the Western Union what interest I had if any. They knowing your contract, you must look to them." Edison apparently turned this matter over to Lowrey in order for him to take action as Western Union counsel. DF (*TAEM* 19:527, 554); Lbk. 3:293, 406 (*TAEM* 28:739, 839).

-1516-

From George Walker

New York, Octo 21" 1878[a]

Dear Sir,

There has been constant complaint with regard to the fragility of the carbon buttons; a new instance coming to my knowledge this morning leads me to address you speceially on the subject—[1] Last week we sent twelve carbon buttons to Mr Merrihew at Philadelphia; they were packed with great care but when they reached him they were reduced to a state of powder. We have had similar experiences from other quarters. Is there not some method by which these buttons can be made more tenacious?—if not, can not you suggest any mode of packing which would be liable to the least objection? It occurs to me that a pill box, capable of holding six buttons, might be made just large enough to receive them, separating them perhaps with paste board buttons and putting cotton at the top and bottom to receive a slight pressure.

As we are likely to have a great many of these to send, and as the inconvenience resulting from their breakage is greater than the cost of replacing them, some method should be devised at once to avoid the difficulty. Please suggest one. Yours very truly,

George Walker Vice Prest.

ALS, NjWOE, DF (*TAEM* 19:780). Letterhead of Gold and Stock Telegraph Co., George Walker, Vice President. [a]"New York," and "187" preprinted.

1. The carbon buttons were manufactured at Menlo Park. The carbon was obtained by burning kerosene lamps and scraping the soot from their chimneys. The resulting lampblack was then placed in a press and compressed into buttons which were carefully weighed (Jehl 1937–41 1:131–32). At the time of this letter, Edison was furnishing some 200 buttons per day to telephone manufacturers, including George Phelps's Western Union shop, Western Electric Manufacturing Co., Sigmund Bergmann, as well as to the Gold and Stock Telegraph Co. of California (TAE to Theodore Puskas, 5 Oct. 1878, Lbk. 3:394 [*TAEM* 28:828]). For other complaints about breakage see George Ladd to TAE, 19 Oct. 1878; George Scott to TAE, 2 and 7 Nov. 1878; Philadelphia Local Telegraph Co. to TAE, 20 Nov. 1878; all DF (*TAEM* 19:779, 782, 791, 795, 800). Orders for carbon buttons are in 78-039, DF (*TAEM* 19:833).

-1517-

To Sampson Low, Marston, & Co.[1]

[Menlo Park,] Oct 22d [187]8

Dear Sirs

I am in receipt of your favor of the 9th inst— The suggestion made by you meets my approval—[2] As soon as the details are worked out I will write a pamphlet on the Electric light and send you the manuscript in advance of publication here—[3] Very Truly,

T. A. Edison per G[riffin]

L (letterpress copy), NjWOE, Lbk. 3:437 (*TAEM* 28:867). Written by Stockton Griffin.

1. London publisher Sampson Low had retired from business in 1875. His firm continued under the name Sampson Low, Marston, & Co. According to their 9 October letter to Edison, the other members of the firm were named Searle and Rivington. *DNB*, s.v. "Low, Sampson"; DF (*TAEM* 17:198).

2. In their 9 October letter (see note 1), the London firm had suggested publishing in England a work by Edison on his electric light inventions just prior to a similar publication in the United States in order to secure the British copyright and rights to translation in countries with copyright treaties. In exchange they proposed giving Edison a ten percent royalty and half the proceeds of translation or reproduction rights in other countries. They suggested that Edison produce "a small book containing a few explanatory diagrams or illustrations."

3. On Sampson Low, Marston, & Co.'s reply to this letter, Stockton

Griffin indicated that he had written Edwin Fox about the proposed pamphlet and he later apparently wrote the firm about Fox. Edison wrote them on 18 December to indicate that he had made arrangements with the New York firm Harper Brothers for publishing the pamphlet in the United States and indicated that "the work will be commenced at once, but owing to the peculiar condition of affairs as regards patent applications, I cannot say definitely when it will be completed." Sampson Low, Marston, & Co. published this letter in January as part of a circular announcing the forthcoming pamphlet. However, the pamphlet was never completed. Sampson Low, Marston, & Co. to TAE, 5 Nov. and 31 Dec. 1878, 13 Feb., 17 Mar. (with enclosures), and 17 Apr. 1879; Edwin Fox to Griffin, 4 Mar. 1879; all DF (*TAEM* 17:226, 266; 49:671, 682, 697, 678); TAE to Sampson Low, Marston, & Co., 18 Dec. 1878, Lbk. 4:52 (*TAEM* 80:25).

-1518-

To Henry Plimsoll[1]

[Menlo Park,] Oct. 23d [187]8

Dear Sir

Your favor of[a] the 21st with introductory letter from Mr Reiff was duly rec'd.[2] I am at present working nights and sleeping during the day and am so busily engaged that for the present I cannot make an appointment. And besides I have transferred my interests in the Electric Light to a Co in New York. It is not my intention to meet the public in a business way with this invention. Very Truly

T. A. Edison G[riffin]

L (letterpress copy), NjWOE, Lbk. 3:441 (*TAEM* 28:870). Written by Stockton Griffin. [a]Circled "C" with arrow written above.

[1] Henry Plimsoll, probably the brother of British reformer Samuel Plimsoll, was seeking safe lights for coal mines. *DNB*, s.v. "Plimsoll, Samuel."

[2] Plimsoll's letter as well as Reiff's 15 October letter of introduction are in DF (*TAEM* 17:974–75).

-1519-

From George Barker

Philada. Oct. 23d. 1878.

My dear Dr. Edison:— (Chevalier de la Legion d'Honneur)[1]

Your letter of the 21st I received this morning.[2] I am glad to know what you write concerning the business management of the Electric Light since now I can refer all who apply to me to Mr. Lowrey. I gave my card a day or two ago to Prof. Chauvenet[3] of St Louis, who came to me seeking just this information.

What you say about the use of your new light for my lecture quite upsets me. You will remember that before I consented to give the lecture, I came to Menlo and saw you about it. And that it was upon your promise to let me exhibit the new light at my lecture, that I agreed to give it. We not only talked about my having it, but we discussed the different forms in which it would be best to put it, and you offered me six of those cast iron stands with the lamp on them. Not only therefore have I promised several of my friends here that I would exhibit the new light at my lecture, but it has been advertised in the papers. I am anxious to make a complete demonstration on the electric light side of the question, and I have been counting on you to help me. As to the Company, I cannot conceive of their having any objection to its exhibition in a public lecture. On the contrary it would be an endorsiment of it which would be of the highest value to them. No, if that is the real reason and you yourself are all right and are anxious for me to have it, I will go to New York myself & with such letters as I can get, I think I could get their permission. Not to have one of your lights there at my lecture after all I have promised, places me in a position before this community which I would rather lose my right hand than occupy. Only two weeks ago and you wrote that you would try and come over to the lecture. Now you dont know whether you can loan me even a light for the occasion. I beg of you not to desert me now. Do let me show something that represents your new invention.

You will find the reasoning of Dr. Siemens[4] upon which Sir. Wm. Thomson reasons so well, upon transmission of electricity, in the discussion which took place in the Institution of Civil Engineers, London, on the evenings of Jan. 22 & 29, and Feb. 5, 1878. It is published in their Proceedings, vol. lii, part 2. I have it in a separate pamphlet & will have it copied, if you care for it. Thomson says "with an exceedingly moderate amount of copper it would be possible to carry the electric energy for one hundred, or two hundred, or one thousand electric lights, to a distance of several hundred miles." Houston & Thompson's electric lamp of which Morton speaks so approvingly, proposes to use vibrating carbons producing a secondary spark at each separation, generated from a large coil in circuit. They think as this secondary spark is so bright they can get a bright light with very little battery power! Trying to lift themselves by their boot straps again!

Thanks for the things you promise to send me. I shall look for the phonograph tomorrow. Don't let my lecture fail will you? Cordially yrs

Geo. F. Barker.

ALS, NjWOE, DF (*TAEM* 17:979).

1. Edison was named a Chevalier of the Legion of Honor (the lowest of the three ranks) at the close of the Universal Exposition in Paris. Official notification of his award has not been found, but New York newspapers of 22 October 1878 carried comment about it and background biographical information (e.g., "The Legion of Honor: Sketches of the Honored Americans," *New York Herald,* and "Decorated Americans," *New York World,* Cat. 1241, items 964–65, Batchelor [*TAEM* 94:383]). The only surviving item in Edison's Legion of Honor folder in Paris records his elevation to the highest rank (Commander) eleven years later in connection with the 1889 Paris Exposition.

2. Not found.

3. William Chauvenet was professor of mathematics and natural philosophy and later chancellor of Washington University in St. Louis. *BDAS,* s.v. "Chauvenet, William."

4. William Siemens headed the London firm Siemens Bros., one of the complex of family enterprises led by his older brother Ernst Werner von Siemens. William made significant contributions in several fields of science and technology. See *TAEB* 3:171 n. 2.

-1520-

From Grosvenor Lowrey

New York, October 23d 1878[a]

My dear Edison

There is an important meeting of the Board of Directors to-morrow and you ought to attend— The agreement will be ready to sign[1]

I think too for various reasons that we ought now, before the thing gets larger to have a talk with Drexel Morgan & Co in respect to matters on the other side; & for this purpose I wish you would bring in any papers or correspondence with Goureau or Puskas which wd enable me to judge more accurately of what is due to them

Much reflection confirms me in the belief that the Electric Light, if it is or is to be what we suppose, requires to be represented by sober business men of the highest commercial standing; and they must make just provision for any claims either defined or undefined,—legal, or moral only, which Mr Puskas or others may assert— The dignity, & importance of the invention to the world, demand that it shall be introduced by men possessing a comparative strength & power in the financial world—

But these men too are to be dealt with carefully; & if you could stay down to-morrow evening, I also would stay in town & we would have a clear talk with Mr Fabbri

The applications come pouring in— I have to-day an urgent application from Wheeler & Wilson[2] to put the thing at once in their great factory at Bridgeport.

How would this suit you for an experiment. It is eleven hundred feet long, & has no light at present because of the risk from fire Yr Trly

G. P. Lowrey

ALS, NjWOE, DF (*TAEM* 18:45). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted.

1. The meeting was adjourned to 31 October and twice more before the agreement was signed on 15 November (Doc. 1576). Edison Electric Light Co. to TAE, 31 Oct., 6, 13, and 15 Nov. 1878, DF (*TAEM* 18:54, 60, 68, 70).

2. The sewing machine firm founded by Nathaniel Wheeler and Allen Wilson. *DAB*, s.vv. "Wheeler, Nathaniel" and "Wilson, Allen Benjamin."

-1521-

Stockton Griffin to Grosvenor Lowrey

[Menlo Park,] Oct 23d [187]8[a]

Dear Sir

Mr Edison has been confined to his bed all day,[1] is suffering from neuralgia in the facial nerves— He had great difficulty in reading your communication.[2] He requested me to say that it is doubtful if he will be able to go to N.Y. tomorrow but he will do so if possible.[3]

Regarding [—][b] the Wheeler and Wilson application he says he very much prefers making his first exhibit of the light at Menlo Park. Very Truly

S. L. Griffin

ALS (letterpress copy), NjWOE, Lbk. 3:444 (*TAEM* 28:873). [a]Circled "C" written above. [b]Canceled.

1. Griffin, on Edison's behalf, also notified Hamilton Twombly of this in a telegram sent at 4:20 that afternoon. Edison had planned meetings with Twombly and with Lemuel Serrell, in the latter case to complete urgent business regarding foreign patents. Twombly to TAE, TAE to Twombly, and George Bliss to TAE, all 23 Oct. 1878; TAE to Serrell and Serrell to TAE, both 22 Oct. 1878; all DF (*TAEM* 16:304, 18:776, 775).

2. Doc. 1520.

3. Edison clearly planned to go but did not. At 8:50 A.M. on 24 October he had Griffin telegraph to Dr. Leslie Ward to come to Menlo Park because he was "quite sick" (Lemuel Serrell to TAE, TAE to Gamble, both 23 Oct. 1878; TAE to Ward, 24 Oct. 1878; all DF [*TAEM* 18:777, 19:563, 16:305]). When Lowrey found Edison was in bed under the doctor's care, he asked if Edison would be ready to undertake business if he came to Menlo Park the next day; he was told that would not work but that Griffin would confer with him in New York instead (four tele-

grams between Lowrey and Griffin, 24 Oct. 1878, DF [*TAEM* 18:47–48]).

-1522-

From George Gouraud

LONDON 24 Octr 1878.[a]

T. A. Edison Esq.
Electric Light

I trust long before you receive this that the enclosed cable will have been replied to and that the Electro Bonanza will be born. I have been visited by a great number of influential people amongst the very first in the City who are all of one opinion that there never was a time so favorable to the launching of a large Company than the present for the Edison Electric Light Company. All conditions are anomalous. There are two hundred and seventy millions of Pounds Sterling ($1,360,000,000) trembling in the balance on the actualities of your—as they call it—"alleged" discovery. The whole scientific world is as busy as a bee in trying to find out how you have done it and the danger of delay comes from this rather than anything else. Besides now we have a universal free advertising such as cannot be bought for money under any circumstances. Every paper throughout the Kingdom has something in it. I have endeavoured to keep you supplied with a fair assortment. It would have been folly to send you all as they naturally say much the same thing.

I am fully of opinion that my friends and advisers are right that now is the time to come out with a Company and that the Capital would be subscribed possibly several times over.

The long Cable concerning Reed and the Rapieff light is the result of several interviews which originated at their request and I have been for several days confined several hours each with Reed and some of his associates who are amongst the leading Bankers here. The result reached with them is expressed in the annexed cable so fully as to make further explanations unnecessary. They began naturally enough by proposing joint interests profits and that sort of thing but I would listen to nothing except upon the basis, if at all, of having Royalties on their thing only where it was used and so they finally expressed themselves as very satisfied. They were frank enough to say that although they were on the point of bringing out their Company when your discovery was announced that in the face of public expectations concerning you and what you probably ha~~d~~ve done that they had no chance to hope successfully to float a Company on anybody's light and so I think the terms as finally agreed to will be found to have no disadvantages to us and indeed have the very important advantage of enabling us to at once proceed with the Company by reason of the fact of our being able immediately to furnish some kind of Electric Light.

GEG

ENCLOSURE[b]

[London] 24 Oct/78

Edison

Can effect promptly the following with your approval E. J. Reed controls Rapieff system already lighting Times printing office and adopted[1] Reed as well as I already have numerous applications for immediate supply light on large scale rumours current of other subdividing inventions one such already registered most desirable occupy field quickly Reed prepared supply light immediately Combination would under present excitement command any capital thus controlling existing and future monopoly proposed immediate issue of Company capital[c] million sterling ~~capital~~ £100 000 cash payable to you advanced Royalties immediately your system is exhibited here your perpetual royalty to be determined by yourself Directors subject to your approval Reeds royalty proportionate on his patents only when used Reeds present outlay £5000 repayable by Company each system to stand on its own merits This combination no disadvantage to us but the contrary General opinion of first-class people here that we should proceed immediately and present availability of Rapieffs light and existing demand justify it Cable reply promptly

Geo E Gouraud

LS, NjWOE, DF (*TAEM* 18:157). Note form of George Gouraud; note form is electric pen copy. [a]"LONDON" and "1878." preprinted. [b]Enclosure is L (telegram, letterpress copy). [c]Written between columns.

[1] The Rapieff arc-lamp system was used in the London *Times* composing rooms. In this system, the usual single set of vertical carbons was replaced by two sets, each in the form of a V. When a current was sent through the lamp, the lower pair dropped away from the upper pair and remained at a constant distance as long as the current flowed. An automatic shunt with a resistance equal to that of the lamp was used to maintain the circuit when the arc was extinguished. Prescott 1879, 509; Dredge 1885, 1:415–20.

-1523-

Telegrams: Edwin Fox to/from Stockton Griffin

October 25, 1878[a]
New York 7 P.M.

S. L. Griffin or Chas Batchelor

Please telegraph me for publication Edisons condition tonight[1] If Dr Ward there[2] will you oblige Herald by getting from him statement of diagnosis and prospect Answer quick

Edwin M Fox N.Y. Herald

Menlo Park, N.J.,[b] 8:35 P.M.

E M Fox

Mr Edison caught a severe cold Sunday or Monday and since Wednesday morning has been suffering from Neuralgia.[3] Dr Leslie Ward says positively that it is merely local and is nothing serious.[4] ~~Says Mr Edison will be out again in two or three days~~ Unless complications arise thinks he will be out in a few days Private. To Fox Ward sanctions the above

Griffin

He is being kept under the influence of anodynes and is comparatively comfortable tonight— Dr.[c] Ward ~~remains~~will ~~here~~ remain here for a time—

L and ALS (telegrams), NjWOE, DF (*TAEM* 16:314). Written by Griffin; letterhead of T. A. Edison. [a]Date from document, form altered. [b]"Menlo Park, N.J.," preprinted. [c]Obscured overwritten letter.

1. Much interest in Edison's well-being was shown during the day. Griffin evidently went to New York to see Grosvenor Lowrey. While he was away Charles Batchelor handled various inquires about Edison's health, and a reporter, Walter Phillips, stated that many rumors were circulating about it. George Prescott to Batchelor, Batchelor to Prescott, Tracy Edson to Batchelor, Batchelor to Edson, Josiah Reiff to Mary Edison, Walter Phillips to Stockton Griffin, all 25 Oct. 1878, DF (*TAEM* 16:310–13).

2. Griffin had telegraphed Dr. Leslie Ward on behalf of Edison about an hour and a half earlier to come to Menlo Park to attend to Edison's wife, Mary, who was about to give birth; at the same time Griffin sent a message from Edison asking Mary's sister Alice Stilwell to come. DF (*TAEM* 16:314, 17:580).

3. October 25 was a Friday. The following day, Fox's paper, the *New York Herald*, carried an article on "Mr. Edison's Illness" (p. 5), which reported that Edison had "complained of neuralgic pains in the face" on Tuesday morning. His discomfort had increased during the day, "and by evening his face had swollen alarmingly, and serious results were feared. The next day his condition was, if anything, worse, and his attendants remained continuously at his bedside. The favorable change occurred yesterday morning." The *Herald* also noted that "on several previous occasions Mr. Edison has been afflicted with neuralgia; but he has never before had such a severe attack."

4. Immediately after receiving Fox's inquiry, Griffin telegraphed a

message from Edison to Lowrey that Edison was still confined to bed though somewhat improved. DF (*TAEM* 16:315).

-1524-

Stockton Griffin to Grosvenor Lowrey

Menlo Park, N.J., 8:54 [A.M.] Oct 26 1878[a]

G. P. Lowrey

No particular change in Mr Edisons condition Dr Ward here all night. Called in Dr Dailey of Rahway this morning on account of Mrs Edisons whose[b] condition ~~which~~ is not favorable.[1] Dr Ward says he will certainly let me know if Mr Edison gets worse and approves of your suggestion to have physicians from NY if necessary[2]

S. L. Griffin

ALS (telegram), NjWOE, DF (*TAEM* 16:316). Letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted. [b]Interlined above.

1. Whether Mary Edison was suffering from anything in addition to difficult labor is unknown. Immediately after this, Griffin sent a telegram from Dr. Ward to his wife saying he would have to stay at Menlo Park at least until 1 P.M. DF (*TAEM* 16:316).

2. No message with such a suggestion has been found. Apparently it was made in Griffin's meeting with Lowrey in New York the previous day.

-1525-

Leslie Ward and John Daly to Edwin Fox

Menlo Park, N.J., 11:15 AM Oct 26 1878[a]

Edwin M Fox[1]

~~Drs Ward and Dailey~~ We have the pleasure to announce that Mr Edison is the Father of a twelve pound boy[2] which came at nine oclock this morning Mother doing well ditto the Father

Drs Ward & Dailey

L (telegram), NjWOE, DF (*TAEM* 16:317). Written by Stockton Griffin; letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted.

1. This was directed to Fox at the "NY Herald office."

2. The 27 October *New York Herald* printed a brief article on the birth of William Leslie Edison under the headline "Edison's Latest. A New Talking Machine Makes Its Appearance in Menlo Park" (p. 7).

Mary and the infant William Edison.

-1526-

To Grosvenor Lowrey

Menlo Park, N.J., 5:09 P.M. Oct 26 1878[a]

G P Lowrey

Been up and dressed this afternoon feeling better got a twelve pound boy all doing nicely[1]

Edison

L (telegram), NjWOE, DF (*TAEM* 16:317). Written by Stockton Griffin; letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted.

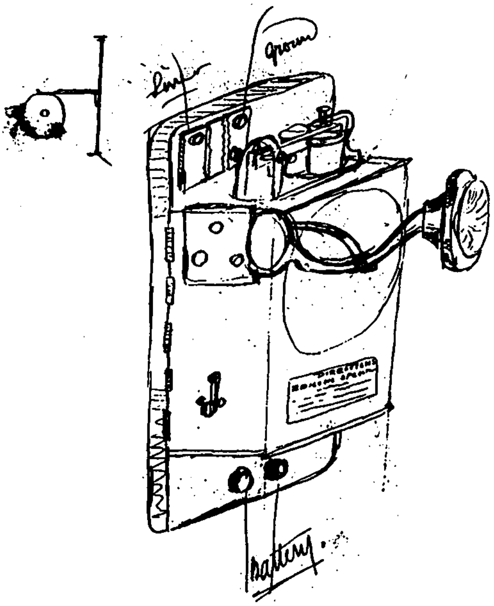
[1] A telegram, sent immediately after this one, from Margaret Stilwell, Mary Edison's mother, to her son Charles, reported "all right here," but said she would stay at Menlo Park until 28 October despite the apparent illness of her husband. Margaret Stilwell to Charles Stilwell, 26 Oct. 1878; Charles Stilwell to Margaret Stilwell, 28 Oct. 1878; both DF (*TAEM* 17:580–81).

-1527-

Equipment Specification: Telephony

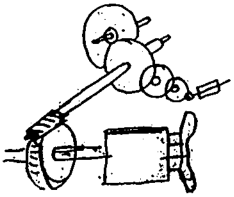
[Menlo Park,] Oct 26 1878

Telephone[a]



Kruesi:—

Make a telephone this pattern and put a clockwork inside to run the "chalk" and make the switch stop and start it. Design the chalk to be turned by a worm as it will not be strong enough without, as there is a strong pressure on the chalk[b]



I think you had better drive from the second shaft and have only a few teeth in the worm wheel B[atchelor]

T A Edison — Chas Batchelor
J Kruesi — M. N. Force

X, NjWOE, Lab., Vol. 18:54 (*TAEM* 4:1089). Written by Batchelor. [a]Underlined twice. [b]Followed by centered horizontal line.

-1528-

Technical Note: Electric Lighting

[Menlo Park,] Oct 27 78

Fundamental experiments
Paint the platina with[a]

Asphaltum
white lead paint
all the pigment paints—[b]

Mould platinum Black[1] under great pressure in split mould[b]

Make a Carbon of a mixture of ½ Carbon ½ Rutile=[b]

Make a cylinder of ⅔ platina black ⅓ of precipitated chalk, use for incandescence.[c]

TAE — Chas Batchelor
M N Force — J Kruesi
Wm Carman — Geo E Carman

X (fragment?), NjWOE, Lab., Vol. 16:166 (*TAEM* 4:615). [a]Followed by blank line with ". [b]Followed by horizontal line across page. [c]Remainder of page torn off.

1. A spongy precipitate of platinum sometimes used in hydrogen and spirit lamps. Pepper 1869, 478.

-1529-

Technical Note: Telephony

[Menlo Park,] Oct 27th 1878

Telephone[a] New Receiver
Discs made to receive on of=
42 grain Hg acet[1b] 30 min[ims] Na solution Not very low but[c] diaphragm squeaks[d]

32 grain Hg 30 min Na caustic very low & diaph. squeaks[d]

44 grains Hg. 30 min Na pretty good & loud no squeak[e]

~~5~~30 grains Hg ~~530~~ 50[b] min Na 50 min Na[d] loud, needs a good deal of pressure though very good call it standard at present[e]

6 grains Mercury 30 soda sol No good Black[d]

42 grains Mercury 50 Min Na loud, needs a good deal of pressure though very good—good as standard[e]

30 grains Mercury 40 Soda Excellent good[a] but squeaks best ye~~s~~t= Have to turn quick[e]

3 grains Mercury 30 Soda excellent good have to turn slow not quite so loud but clearer than previous one[f]

36 grains Acetat Hg and 40 min Soda Solution too low to be of use—no good—[d]

3 grains Acet Hg and 40 min Soda Sol. pretty fair but not up to Standard[d]

42 grains Mercury 40 Soda Solution B~~e~~roke[d]

18 grains Mercury 40 Soda Solution very good when turned slow—diaph. squeaks[e]

36 grains Mercury 20 Soda Solution middling fair articulation—makes considerable noise[g]

24 grains Mercury 20 Soda Solution pretty[c] good. seems to want Stiffer diaphragm[e]

36 Mercury Acet 30 Soda Solution Bang up good best yet!!! loud & clear Broke after[h]

12 grains Mercury 30 ~~g~~min Soda Solution not very loud but works with light pressure

=30 grains Acet. Mercury. 20 minims Soda Solution very poor. makes squeaking noise and when you turn fast it almost entirely disappears Broke taking out[i]

=6 grains Acet Mercury. 40 minims Soda Solution[d] This is an elegant one, gives the natural voice and requires no pressure so being good for clockwork. very loud: squeaks a little[j]

=42 grains Acet. Mercury 20 minims Soda Solution Not good enough= fair artic. but too low[d]

12 grains Act Merc. 20 minims Soda Solution poor not loud enough[d]

24 grains Acet. Mercury 40 min. Soda Solution no good[d]

18 grains Acet Mercury 20 min Soda Solution No good

3 grains Acet. Mercury 20 Soda Solution Fair but low[d]

18 grains Acet. Mercury 30 Soda Solution This is the Boss of the heap very loud and clear but it shake the diaphragm so that it rattles.[k]

12 grains Acet. Mercury 340 Soda Solution No good. not loud.[d]

Set the two best in the instruments and left them.

TAE Chas P Edison
Chas Batchelor J Kruesi
M. N. Force

X, NjWOE, Lab., Vol. 18:55 (*TAEM* 4:1090). Written by Batchelor; document multiply signed and dated. [a]Underlined twice. [b]Interlined above. [c]Obscured overwritten letters. [d]Followed by centered horizontal line. [e]Followed by centered horizontal line and large X in right margin. [f]Followed by large X in right margin. [g]"Middling . . . noise" written by Charles Edison; followed by centered horizontal line. [h]Followed by two large X's in right margin and centered horizontal line. [i]Followed by centered horizontal double line. [j]Followed by large X in right margin, centered flourish and centered horizontal line. [k]Followed by large asterisk in right margin and centered horizontal line.

1. The following day Batchelor noted of discs made from mercury acetate: "We found that the current on line goes out through the transmitter but enough battery current also escapes through to affect the motograph very considerably & that by putting an extra cell in line & not changing the line or Battery wires we can get excellent talking." He and Charley Edison proceeded to make extensive experiments with different acetate mercury discs. These continued through 30 October, when Batchelor tried a diaphragm that was twice as thick as their standard and used a mixture of 3 grains acetate mercury and 20 minims soda solution which he called "red hot for articulation." After further experiments with thicker diaphragms and other solutions, he wrote "It seems to me that we want a greater percentage of caustic soda in the 'chalks.' So make a concentrated solution of it and try 3–20 on it." On 31 October they conducted extensive experiments with chalks made from 3–42 grains acetate mercury and 20–50 minims of "caustic soda solutions of different strengths." On 1 November, Batchelor also made a table showing the results of tests from the previous day of eight telephone boxes, each with a different chalk, and the result after they dried out overnight. They then "put large cells water in each with waste to see if any change tomorrow night," but only one of the boxes did not change. After more tests, Batchelor concluded at 6 A.M. on the morning of 2 November that "all chalks made with strong solutions of soda are much more brittle than those tried before." He also noted that 6 grains of acetate mercury with 30 minims of their No. 1 solution of caustic soda (5½ pennyweights of soda with 2 oz. of water) worked "Bang up just as good as original," and this appears to have become the standard mixture. Vol. 18:59–67, 69, 71, Lab. (*TAEM* 4:1094–1102, 1104, 1106); Doc. 1553.

-1530-

From William Croffut

New York, Oct. 28, 1878[a]

My Dear Edison:— (Batchelor, Griffin, et al.)

Telegraph me just as soon as you are willing to have that lamp & new telephone fully described. Don't let Cummings get ahead of me!

A photographer will come down with me to see if your light can be applied to photo-lithography.

Kiss the baby for me. Yours Very Truly

W. A. Croffut

I had long article about Edison in Indiana State Journal (Indiapnapolis) of yesterday.[1]

ALS, NjWOE, DF (*TAEM* 17:212). Letterhead of The Graphic Company. [a]"New York," and "187" preprinted.

[1] Croffut's article appeared in the *Indianapolis Journal* on 27 October (p. 5) as "Edison Tells the Story of His Electric Light—More Wonders Coming." The headline apparently referred to Edison's promise that in a few weeks he would show Croffut "something new, and as important as anything I have ever made. I am on the track of it, and I believe it will revolutionize—hold on, though. I mustn't tell any more now."

Croffut based his article on a 22 October interview, just before Edison became ill. He reported finding Edison "up stairs in a tangle of wires of which he was trying to make a new telephone. He was looking rather worse than usual—with blood-shot eyes and a week's beard, and the general air of not having eaten or slept for three or four days." Croffut described the electric light and also made a rare public mention of Edison's daughter. When Croffut asked if the light was harmless, Edison reportedly replied, "'O, entirely; it couldn't hurt a child; could it, Dot?' and he snatched up a little girl of five, his oldest, fair-haired, blue-eyed, the picture of her mother. She was eating a sugar cake and seemed happy, which suggested something to the father, for he put her down, went and lighted his pipe and pulled at it for a minute or two with great satisfaction."

-1531-

Telegrams: Grosvenor Lowrey to/from Stockton Griffin

October 28, 1878[a]
NY 10:50 AM

Griffin

How are Mr & Mrs Edison today

Grosvenor P Lowrey

Menlo Park, N.J.,[b] 10:50 AM

Grosvenor P Lowrey[1]

Both better[2] I will call on you at one P.M.

Griffin

Menlo Park, N.J.,[b] 7:53 P.M.

Grosvenor P Lowrey Esq[3]

Edison says come. If possible bring Dr. Keyses[4] Edison suffering great pain tonight—

S. L. Griffin

NY 11:20 P.M.

S. L. Griffin

I will go out about noon Dr Keyes will go by one forty train if possible to get away Edison's Doctor should meet him[5]

G. P. Lowrey

L and ALS (telegrams), NjWOE, DF (*TAEM* 16:332–33, 331). Written by Stockton Griffin; letterhead of T. A. Edison. [a]Date from document, form altered. [b]"Menlo Park, N.J.," preprinted.

1. This was sent to Lowrey's business address, 3 Broad St.

2. Apparently, however, their recoveries were soon troubled by a serious problem with the heating system; a telegram from Edison was sent just after noon to McCormick & Co., a New Brunswick plumbing & heating firm, calling for workmen to be sent immediately lest they should "freeze to death" (DF [*TAEM* 16:330]). Later messages indicate that the system was a hot air central heating system with a basement furnace (a type then becoming fairly common in newer middle-class homes) and that adequate registers for delivery of the hot air to the upper floor of the house had not been provided previously. TAE to McCormick & Co., 7 Nov. and 31 Dec. 1878, DF (*TAEM* 18:520, 580); Cohen 1982, 51–52.

3. This was sent to Lowrey's residential address, 34 W. 15th St., after Griffin returned from New York.

4. Probably physician Edward Keyes, a professor at Bellevue hospital in New York who was particularly noted for pioneering work in dermatology. *DAB*, s.v. "Keyes, Edward Lawrence"; Wilson 1879, 772.

5. The following morning Lowrey wired Griffin that he and Keyes would come out on the 10:55 train, and Griffin on Edison's behalf telegraphed Dr. Leslie Ward to meet them. DF (*TAEM* 16:345).

-1532-

To Grosvenor Lowrey

MENLO PARK, N.J.[a] Oct 29, 1878

Dear Sir[b]

Referring to the power of attorney which I have given to you under date Oct 17—1878[1] to sell all my interests in my inventions for Electric light for Great Britain, and to conversations in which you have informed me of your proposition to interest an important banking house of New York and their correspondents in Europe to sell those rights in England I now have to say that I approve the policy adopted by you which I understand to be as follows substantially; you are to select a suitable banking house and induce them to under[take][c] sale of these patents in partnership with me in order that I may have the utmost benefit of their skill, judgment and facilities without having occasion to fear that they may have some ulterior interest different from my own— Leaving you to secure the arrange[ment][c] properly according to this principle I hereby authorize you to retain one half the net pro[fits][c] of all compensation which may be paid for said patents whether in the form of royalties or present compensation or otherwise, and [?][c] of this you are to satisfy the claims of [this?][c] banking house and all their agents so as to leave me after the payment of the exp[enses][c] of taking out patents and bringing out, exhibiting, and disposing of the inventions in receipt of one half the net result. In short the Banking house which you may choose, is to be made strictly a partner with me in all respects and to the fullest extent with all the advantages & mutual obligations resulting from that relation.

I shall expect you through your friends to satisfy any reasonable claim made by Col. Gouraud for any services which he may have rendered, desiring you to be not only just to him but to save me from any fair cause of complaint by him; this to be treated as one of the expenses.[d] For the purpose of making this arrangement secure against my death or any accidental cause which might (after the Banking house on the other side shall have announced to the public that they are authorized to bring out this invention) occur to put it out of their power to keep this promise I will execute such further papers or conveyances to yourself and Mr Egisto P. Fabri in trust to sell and deliver the same in accordance with the engagements of your substituted attorney on this other side as may be required.[e] I leave you to negotiate the minor details of which we have spoken including the matter of advances for expenses and for my journey to England to superintend the setting up of the light. I will make the same conveyance to the English Compy that I have to the Edison Electric light Company of New York ie all inventions made within five years to be conveyed without further compensation than that to be at present agreed upon and the Company or [purchaser?][c] to have the first option at a price to be fixed by arbitration to take any inventions or improvements made after the expiration of the five years and during the continuance of the first patent granted to me and which will be in Great Britain fifteen years. Yours Truly

Thomas A Edison

LS (letterpress copy), NjWOE, Lbk. 3:450 (*TAEM* 28:879). Written by Stockton Griffin. [a]Place from Edison's laboratory handstamp. [b]Circled "C" written above. [c]Faint copy. [d]"; this to . . . expenses" written by Edison. [e]"as may be required" interlined above.

1. Not found.

-1533-

From Partrick & Carter

Philadelphia, Oct 29 1878[a]

Dr Sir=

We have started in and are now making the Voltameters Thermoscopes and Tasimeters,[1] and we propose at once to send out a circular to every college in the country= We propose to sell the Tasimeter alone without Galvanometer, please let us know what you think a fair price to charge for them, also for Voltameters & Thermoscopes. please send us a rough sketch[b] of the kind of circular, and also send us your letter giving us the authority to manufacture and sell them, which we will publish on the circular and will no doubt aid the sale of them much.=[2] We think you are treating us rather bad in way of money as we manufactured them for cash as we supposed, and as there was no profit in it, we think you might send us a check after waiting so long=[3] please reply also about the Slit in Tasimeter to be used for spectroscope[4]

please reply with check And oblige

Partrick & Carter

L, NjWOE, DF (*TAEM* 16:342). Letterhead of Partrick & Carter, Practical Telegraphers and Electricians. [a]"Philadelphia," and "187" preprinted. [b]Obscured overwritten letter.

1. By early October, Edison had apparently arranged with Partrick & Carter to manufacture and market these devices. Partrick & Carter to TAE, 8 Oct. 1878, DF (*TAEM* 16:199).

2. Edison had not answered by 7 November, when Partrick & Carter asked him to "please answer our letter and send us your authority for making Tasimeters Thermoscopes etc, we want to get circular out and send to all the colleges." It is unclear if Partrick & Carter received a reply from Edison before mid-December, when they acknowledged receipt of a postcard from him and indicated that the tasimeters were "almost done." They also told Edison at that time that they had been waiting to finish the tasimeters before having the circulars prepared. On 14 January, they sent Edison three tasimeters for his inspection and to have the carbon buttons placed in them. They subsequently urged him to return these quickly as they had parties interested in buying them. One of these parties may have been Wolcott Gibbs, professor of chemistry and physics at Harvard University, who complimented Partrick & Carter on their workmanship. However, by mid-March they had sold only one tasimeter. Edison's response to a letter from Joseph Tingley, professor of natural philosophy at Indiana Asbury University, suggests a reason for the poor sales: "The delicacy of the Tasimeter depends entirely upon the expertness of the manipulator it may be made infinitely delicate The delicacy exceeds our present means of screening it from local heat currents." Partrick & Carter to TAE, 7 Nov. and 18 Dec. 1878, 14, 18, and 27 Jan. and 14 Mar. 1879; Edison's marginal note on Tingley to TAE, 5 Feb. 1879; all DF (*TAEM* 16:405, 525; 49:63, 68, 51:827–29).

3. This apparently refers to money due from the telephones they had manufactured for Edison the previous summer. They had been trying

to collect this money since mid-August. At the end of that month Edison had sent $100 at which time James Partrick acknowledged the "small favor thankfully received" with hope for the balance to be sent the following week. On 19 October, Partrick & Carter had written regarding the standard setting for the tasimeter at which time they asked him for a check for $304.50 "as we are sadly in want, while you are revelling in luxury and forming Electric Gas lighting Companies, who represent their millions." They were still waiting for the money on 14 November, when Partrick tried a personal approach: "Dr Tom= If you wish to do a friend a favor who is truly in need, please send me the amount due as we are badly off and have got to raise $6000 by the first of December— We are badly off and I appeal to you for help and I hope you will not refuse. . . . We are hard up and cannot tell where to turn unless to you." This apparently worked as Edison wrote them the same day to say that he would send a check on the 16th. Edison's accounts show that he paid $300 on 18 November and the remaining $4.50 in December. Partrick & Carter to TAE, 16, 22, and 31 Aug., 19 Oct., 11, 14, and 15 Nov. 1878, DF (*TAEM* 17:417, 421–22, 442–43; 16:275); Ledger #3:103, Accts. (*TAEM* 87:54).

4. On 26 October, Partrick & Carter had written Edison, "We have call for a Tasimeter with good slit for spectroscopic work—what do they want please notify us and we will answer them=answer quick." DF (*TAEM* 16:318).

-1534-

Telegrams: Grosvenor Lowrey to/from Stockton Griffin

October 30, 1878[a]
[New York,] 10:00 AM

S. L. Griffin

How are the three patients— See "world" this morning—[1]

G. P. Lowrey

Menlo Park, N.J.,[b] 10:02 AM

G P Lowrey

All doing nicely Edison slept twelve hours solid no pain[2]

S. L. Griffin

L and ALS (telegrams), NjWOE, DF (*TAEM* 16:346). Written by Griffin; letterhead of T. A. Edison. [a]Date from document, form altered. [b]"Menlo Park, N.J.," preprinted.

1. Lowrey is probably referring to an article in the *New York World*, titled "Is This the Solution," which details the Sawyer-Man electric light. Cat. 1241, item 990, Batchelor (*TAEM* 94:401).

2. Edison nevertheless told others he was still sick and did not go to the lab that day. The next day Edison was up and about but apparently he did not attend the Edison Electric Light Co. directors' meeting, sending Griffin to New York to meet Lowrey instead. The following day (Friday, 1 November), Dr. Leslie Ward indicated that Edison was well enough that he need not see him again until after the weekend, and Edison concurred. TAE to Howard Butler and TAE to E. N. Bishop, both 30 Oct. 1878; Ward to TAE and TAE to Ward, both 1 Nov. 1878;

Griffin to Lowrey and Lowrey to TAE, both 31 Oct. 1878; all DF (*TAEM* 16:347, 365; 18:55–56).

-1535-

From Grosvenor Lowrey

New York, Oct 30th 1878[a]

My Dear Edison:

I enclose a letter which has been written by my suggestion. Dr Tucker[1] seems a very intelligent, gentlemanly man who says what he wishes to see is yourself rather than the light. He has been waiting here for a week, and I think it would be well to appoint an interview with them for Saturday. You can fix the time and let them know at the Astor House[2] about the trains so that they will take but little of your time, probably.

I am going to have Johnson[3] go through all the Sawyer, and Sawyer-Man patents tomorrow. Mr Man,[4] who says he he has contributed the mechanical part is a very highly respectable person and of good social standing, whom I am sure would not consciously engage in anything in the nature of a swindle.

Mr Sawyer[5] seemed a good talking man, and they both said that the publication showing that you had an electric light with the claims stated in the "Scientific American"[6] for them was like a thunder clap to them in as much as they consider everything which has been described as being used as being also covered by their patents.

I asked their attorney's name but Sawyer declined to give it; he said however it was not Dickerson.[7] We have already retained Dickerson some days ago.

I am going to start a journal of all the foreign business so that whoever goes abroad shall have a complete history of it. I have therefore asked Mr Goddard,[8] the Secretary of the domestic company, to go over on Friday and make copies of everything in your letter books or on your files relating to foreign matters. Very Truly

G. P. Lowrey K[ent]

L, NjWOE, DF (*TAEM* 18:49). Written by Rockwell Kent; letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted.

1. Dr. Robert Tooker wrote to Edison on behalf of himself and two associates in the Western Electric Light Co. of Chicago. One of these men was John Barrett, superintendent of the Chicago fire-alarm telegraph, whom Tooker noted "has devoted much time in experimenting with the electric light." Tooker wrote Edison that "we are well aware of its embryotic condition but have full faith in your ability to bring it to perfection." Tooker to TAE, 30 Oct. 1878, DF (*TAEM* 17:1010).

2. Tooker wrote Edison on Astor House stationery and was apparently staying at the famed hotel on Broadway and Vesey Street.

3. It is unclear if Lowrey meant Edward Johnson.

4. Lawyer Albon Man had become associated with electrician William Sawyer's experiments on electric lighting in the winter of 1878 and was joint inventor on several patents. Together they formed the Electro-Dynamic Light Co. in the summer of 1878. Man's testimony, pp. 402–3, *Sawyer & Man v. Edison (U.S.)*, (*TAEM* 47:9).

5. Electrical inventor William Sawyer, who had for a time been a newspaperman, took out several telegraph patents during the 1870s. Prior to his involvement with Man, he had conducted some electric light experiments while associated with James Flanagan at the Coal and Iron Exchange, receiving his first electric light patents in August 1877. Sawyer's testimony, p. 972, *Sawyer & Man v. Edison (U.S.)*, (*TAEM* 47:297); U.S. Patent Office 1882, part 3, s.v. "Sawyer, W. E."

6. The *Scientific American* of 2 November (39:272), which would have been available about ten days previous to that date, included the following description of Edison's light in an editorial titled "The Electric Light and the Gas Companies.—Remarkable Effect of a New Invention in the Stock Markets":

> It is based on the well-known fact that a wire may be heated by an electric current, the basis of many attempts to accomplish what Mr. Edison claims to have done. The reader may have seen the gas jets of the dome of the Capitol at Washington, lighted by similar means. Over each burner is placed a coil of platinum wire, which, when heated by the electric current, ignites the gas. Mr. Edison uses the coil itself as the source of light, the current sent through it being strong enough to make the coil white hot, or self luminous. The difficulty to be overcome at this point was the liability of the wire to fuse and spoil the light; a difficulty which Mr. Edison claims to have obviated by the introduction of a simple device which, by the expansion of a small bar the instant the heat of the coil approaches the fusing point of platinum, interposes a check to the flow of the current through the coil. This automatic arrangement, in connection with an auxiliary resistance coil, secures, it is said, an even flow of electricity through the coil, and consequently a steady glow of pure light. If this is done economically it is obvious that a marked advance has been made in artificial illumination.

7. Edward Dickerson, Sr., was a technical expert and eminent patent lawyer. He had served as one of the main attorneys for Western Union in the Quadruplex Case, cross-examining Edison for several days. On 31 October, Lowrey told Edison that the Edison Electric Light Co. board of directors "authorized today the employment of Mr Dickerson, as counsel, with authority to employ such experts as he may elect, to examine the state of the art &c &c." Lowrey also suggested Moses Farmer as expert because of his experience with incandescent lighting. *DAB*, s.v. "Dickerson, Edward N."; Dickerson's argument for defendant, Quad. 73.15 (*TAEM* 10:726–72); Quad. 70.7 and 71.1 passim (*TAEM* 9:403–762, 800–817; 10:5–202); DF (*TAEM* 18:56).

8. Nothing is known of Calvin Goddard apart from his role as secretary of the Edison Electric Light Co.

-1536-

From L. A. Ludwig

N York Oct 30th 78

Dr Sir

The following is the a/c of Phonograph receipts, up to date—as furnished me by Mr Smith—

2 Exhibition at Aspinwal[1]	Gross	$26.75
1 " " Panama	"	70.00
1 " " Punta Arenas [Costa Rica]	"	28.00
2 " " San Jose Costa Rica	"	92.00
1 Private Exhib " "	"	15.00
1 Exhibition at Cartago[2]	"	15.00
		$246.75[a]
Deduct 15% for depreciated currency		37.00
		$209.75
Due T. A. Edison 15%		31.50

Enclosed please find my check for the amount $31.50 which please acknowledge— Mr Smith says if he had a Phonograph which would give 50 or even 30% better ~~h~~results he could triple the receipts— I spoke to you some time since in regard to one of the new ones and you promised to let me have one for $75 net—[3] Please therefore pick me out the best working Inst you have on hand & advise me when I can have it & where I can get it—if from Bergmann please give me an order—but if at Menlo Park can you have it securely packed in a convenient box which will do for Transhipment— I should also like to have some information in regard to selling them throughout South & Central America— Can you help me in regard to terms—for how much can I get the $125.00 Instrument (as agent) will it be the same price that I pay you for the one for ourselves personally? Smith asks in regard to the Phonomotor—has it been perfected yet or when is it likely to be?

I applied to Mr Bergmann for 12 Telephones complete— he says he can let me have them if you dont want them—[4] I have today rec'd a telegram from Smith urging their shipment at once & I hope you will be able to let me have the whole dozen— vessels sails about Nov 9th & they should be shipped on the 6th or 7th Subject to your approval Mr Bergmann will I think allow me 30 to 60 days time—although I may not need that much as I expect a considerable remittance in the course of two weeks proceeds of 1 Doz Electric Pens & several Telephones sold in Costa Rica— I shall probably be able to pay for them in 2 weeks time & hope you will be able to accomodate me & inform Mr Bergmann to that effect—he seems to think that he would have to pay you your share at once although I understood that you were willing to wait if he was— Smith is endeavoring to Introduce the Telephones into the railroad systems down there & from his despatch of this morning urging their shipment for that purpose I judge he has every prospect of success & hence I am very anxious to get these 12 asked for at once— There are parties down there in Colombia & Central America who are endeavoring to get ahead of us by acquiring from their Govts the exclusive permit to put up Telephones One Robinson is trying this in Colombia—in view of this fact can you not give us the exclusive agency for the Telephone in Central & South America?[5] This will enable us to cut those fellows off—advertise ourselves as exclusive agents for your Telephone—& also to apply in each state for these permits to introduce them— You know that Smith is energetic & reliable & likely to do very well in that country—much more so than any one else— we have already ordered 22 Telephones from you—10 of which we have & we would have had more had we been able to get them— I am satisfied that Mr Smith will be able to make a better show for you as the exclusive agent for the region in question than if you sold to any one who applied as their order is ultimately bound to reach you through us— If you decide to let us have this agency will you please notify your selling—"Foreign Agents" here to refer all Central & South American ~~ag~~ enquiries to me— I enclose slip from the Herald relative to Bells patent in Colombia[6]—the exclusive privilege in question is of more value & is more of a protection to him than half a dozen patents— Hoping to have an early & favorable reply I remain Yours very Truly

L. A. Ludwig

ALS, NjWOE, DF (*TAEM* 16:351). [a]Overwritten "240.00".

1. Aspinwall was the former name of Colón, Panama.

2. Though it is unclear if Ludwig is referring to the town in Costa Rica or Colombia, the former is located only fourteen miles southeast of San Jose.

3. On 1 November, Ludwig again wrote Edison about the phonograph, which he indicated would be used only for their exhibitions. Later in the day, he wrote again to say that he had seen Edward Johnson who was willing to furnish one of the $125 phonographs at a discount if Edison would waive his royalty. On 4 November, Stockton Griffin replied that Edison did not want to waive the royalty and suggested that Ludwig make the best bargain that he could with Johnson. DF (*TAEM* 16:369, 371); Lbk. 3:474 (*TAEM* 28:900).

4. Edison replied on 1 November that Ludwig could have any telephones he could get from Bergmann and indicated he would sign an order for them, but that he wanted Johnson to test them before they left Bergmann's shop. The same day, Ludwig enclosed an order for twelve box telephones to be sent to T. J. Smith at Punta Arenas. In his letter to Ludwig of 4 November, Griffin enclosed an order to Bergmann for ten telephones and on 7 December, Ludwig wrote that he had obtained these telephones from Bergmann and would send Edison his royalty. On 26 December he sent a royalty check for twelve telephones and two dozen carbon buttons, paying ten dollars per telephone and ten cents per button for a total of $122.40. DF (*TAEM* 16:370–71; 19:989, 994); Lbk. 3:466, 474 (*TAEM* 28:892, 900).

5. In his 1 November letter, Edison told Ludwig, "Cant possibly let you have exclusive agency, or rights, but as you are the only one selling the instruments there, I will put all I can in your hands." Lbk. 3:466 (*TAEM* 28:892).

6. Not found.

-1537-

From Porter, Lowrey, Soren & Stone

New York, Oct ~~2~~ 30th 1878[a]

Dear Sir:

Mr. Lowrey directs me to send you a few hurried notes of a conversation had with Mr Sawyer this morning Yrs Very Respy

E W Griffiths[1]

ENCLOSURE[b]

Notes of a conversation with Sawyer this morning—G.P.L.[c]

Sawyer-Man Electric Light

They claim to have patents for

I Utilizing the carbon point without consuming it

II Regulating the amount of light from taper up: for dividing the amount of Electricity

III For passing the current by certain[d] lights so that the resistance offered by one light will not materially affect the others in the circuit

Mr Sawyer had made, more than a year ago, a burner in which he made use of platinum wire to produce the light, a shunt by means of a magnet, which with the increase in the current of electricity closed allowing the over-plus to pass off, thus preventing the fusing of the metal.

They claim to have patents covering all these things, and all means by which the amount of light can be regulated, by which platinum wire can be utilized, by which an over-flow can be had of the over-plus electricity.

They (or Sawyer) had seen a lamp in which the lengthening of the platinum wire or a wire by expansion[e] was made to work as a means of regulating the amount of electricity.

Mr Sawyer claims partly by patented devices, and partly by secrets (which he will patent if anybody finds them out) to have discovered a means of making carbon incandescent without consuming it— He claims that he has tried and abandoned all effort to get light from the incandescence of metals because ~~he found it~~ it is[f] so much more economical of power to make carbon incandescent[g]

L, NjWOE, DF (*TAEM* 18:51). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted. [b]Enclosure is a D in an unknown hand. [c]Sentence written by Lowrey. [d]Interlined above by Lowrey. [e]"or . . . expansion" interlined above by Lowrey. [f]"it is" interlined above by Lowrey. [g]Paragraph written by Lowrey.

1. Unidentified.

-1538-

To Lemuel Serrell

[Menlo Park,] Oct 31 [187]8

Dear Sir

Please make out a list of all US patents from the earliest ages to the present time on Electric light and send for them for me Want them right off. Also on magneto machines Charge to Edison Electric light Co—

I would like at once official Gazette Sept 11th 1877 Sawyers E light No 195 174 July 16. 77— Very Truly

T. A. Edison G[riffin]

L (letterpress copy), NjWOE, Lbk. 3:465 (*TAEM* 28:891). Written by Stockton Griffin.

-7- November 1878

During November, Edison began to pay increasing attention to the system requirements for electric lighting. To aid in his research, he purchased a large number of books and journals related to the subject, including several on gaslighting.[1] These last were useful for the comparisons he was beginning to make between the operating costs of gas, arc, and incandescent lighting systems. Edison and Batchelor also made comparisons between Edison's incandescent lighting system and that of Willliam Sawyer and Albon Man described in *Scientific American.* They concluded that the latter "would want enormous large conductors owing to the small resistance in each carbon."[2] While considering the issue of cost, Edison formulated an "electric light law" regarding the relationship between the radiating surface of a light and the horsepower required to run it.[3] At the end of the month, he designed his first electric meter, which would make it possible to charge customers using his system.

As he considered the cost of incandescent lighting, Edison began to make comparative tests of the three commercial generators he had in his shop: the large and small Wallace machines and the Weston. He also continued to develop his own designs. At the beginning of November his machinists were building the tuning-fork ("harmonic") generator and at the end of the month they built a new disk dynamo.[4]

Lamp design continued during November as well. His staff made experiments with all the highly infusible metals as potential burners. One set of experiments that seemed particularly promising involved the use of finely divided metals coated with highly infusible non-conductors he termed "pyroinsulators." Edison was so delighted by this design that he arranged a telegraph conversation with his patent attorney, Lemuel Serrell, so that he could immediately file a British provisional specification for it. Experiments with pyroinsulators continued through the month of November. Edison also renewed his efforts to develop incandescent lamps in which the burners were heated by carbon arcs.

On 15 November, Edison finally signed a contract with the Edison Electric Light Company, assigning rights to his light for North and South America, excluding Spanish possessions, in exchange for stock, royalties, and $30,000 for experimental and other expenses. To reassure those investors concerned over William Sawyer's and Albon Man's claims of priority, he had previously agreed to a patent and literature search. In mid-November, he hired Francis Upton for this purpose; Upton had just begun working in the offices of the Gold and Stock Telegraph Company after returning from Berlin where he had studied physics with Hermann von Helmholtz. Some of the investors also came out to Menlo Park to see his experiments.

Having concluded arrangements for American rights, Grosvenor Lowrey now pressed forward with negotiations for foreign rights; he hoped to make arrangements with Drexel, Morgan & Company and invited both Anthony Drexel and J. P. Morgan to Menlo Park. Edison's British patent solicitors noted that press reports there were causing a great excitement about his light, but they cautioned that premature publication of his improvements could threaten his foreign patent applications. In Germany, the December 1877 *Scientific American* article announcing the phonograph became the basis for opposition to his phonograph patent application there.[5] Serrell therefore suggested suppressing any publication until the period for objecting to an application had passed,[6] but Edison found it hard to refuse his reporter friends' requests for interviews.

While the rest of the laboratory focused on electric lighting, Charley Edison continued to experiment with the electromotograph telephone receiver. He attempted to determine the best resistance and amount of moisture for the chalk buttons and experimented with types of containers for them and methods of keeping them wet. He also experimented with different sized buttons and diaphragms of different materials and tried to find a way to reduce noise from the mechanism used to keep the chalk button wet. Finally, he discovered that the resistance of the transmitter affected the operation of the receiver. As Charley improved the receiver, Edison began to negotiate with Western Union and Gold and Stock regarding a new contract for it.

By November, Edison, Johnson, and Uriah Painter had become so dissatisfied with the management of the Edison Speaking Phonograph Company that they took over control of the company, with Johnson assuming day-to-day management. They also brought Josiah Reiff in as an investor and director. During November, Johnson began to sell the new all-brass phonographs, but there proved to be a limited market for these expensive instruments.

Edison again hired more staff members during November. Analytical chemist Henry McIntire became the first college-educated chemist at the laboratory, William Taws ran the new steam engine, John Randolph did general cleaning and other work around the laboratory and office, and Joseph Knight began to make carbon buttons at the end of the month.[7] Local workmen continued to construct the new brick machine shop and office buildings.

1. Wilmer & Rogers News Company to TAE, with enclosed list of periodicals, 1 Nov. 1878; list of books, c. 2 Nov. 1878, DF (*TAEM* 17:358–59, 362).

2. Doc. 1590.

3. Doc. 1577.

4. Cat. 1185:348, Ledger #3:181, both Accts. (*TAEM* 22:699, 87:90).

5. Doc. 1625 n. 1.

6. Doc. 1554 n. 2.

7. Taws to TAE, 22 and 30 Oct. and 11 Nov. 1878; McIntire to TAE, 25 Oct., 1 and 5 Nov. 1878; Timesheets; all DF (*TAEM* 16:433; 17:517–21, 525, 789–90, 800–2, 811, 813–14, 821, 826).

-1539-

To Norman Lockyer

Menlo Park N.J. Nov 1—78

My Dear Lockyer,

Yours of the 15th ult. was rec'd day before yest'y[1] I am just out of bed where I have been for a week suffering from severe cold & neuralgia—

I did not receive Fox's telegram until the last train had left the Park and consequently I could not get to the City— I was very sorry that you could not find time to come down to my Ranche and see the cattle

Hereafter I will try and let "Nature" have[a] the cuts first but for heavens sake dont write any articles about me predicated on interviews with reporters because those fellows come down here and if I happen to be away they grab hold of the young man who makes lamp black interview him, go back to NY and write a long article making me responsible for the[a] whole conversation. This will account for some of that balderdash which the English press delight in publishing and then making a guage for me on the strength of it—

Electric Light. Dont buy any Gas Shares it is'nt good to hold now Electricity[a] is going to win the day—

Tasimeter. I had 8 of these instruments made but they are gone now I sent Barrett one also one to John Browning to make others by. The others went the Lord knows where—however I am another lot made will send you one.[2]

I hope you will come over here again (after you have become well smoked up in London) with several other deep and mighty intellects we will take to the mountains for a grand hunt. Believe me, Yours Truly

Thos A Edison G[riffin]

L, UkExU, Lockyer. Written by Stockton Griffin. [a]Obscured overwritten letters.

1. Doc. 1501.

2. Besides the ones sent to Barrett and Browning, there were only two other known tasimeters (Doc. 1364 n. 1). There is no evidence that Edison had any more made.

-1540-

To Lemuel Serrell

[Menlo Park,] Nov 1 [187]8

Dear Sir

Please hurry up with the telephone cases and Electric light— we will attend to the notary part here.[1]

I have lots more business for you and may crowd you if you dont clear up whats on hand Very Truly

T. A. Edison G[riffin]

L (letterpress copy), NjWOE, Lbk. 3:471 (*TAEM* 28:897). Written by Stockton Griffin.

1. See Doc. 1358 n. 1.

-1541-

From George Gouraud

LONDON, 1st Novr 1878[a]

Personal

My dear Edison,

Combining with Bailey

—The addition of the word "emphatically" in your cable yesterday ("alone emphatically")[1] quite threw me off the track coming so soon after my long and expensive cable correspondence about the Electric Light. I thought you ~~preferred my being~~ meant that I should be[b] "alone emphatically" in the negotiations. Then I thought alone emphatically as regards combining with other Lights and now, no sooner have my letter and cable to you left the office than it flashed upon me that the "alone emphatically" referred[c] to the cipher word "alone" as regards Bailey[d] I gave you in my letter of the 18th inst—[2] My reply however was equally appropriate to both cases.

In the light of your recent advices to me I do not see how it is possible that you can have approved Puskas's combination on the continent but with that affair I have nothing to do. It has always been a mystery to me why he has combined with Bailey but you may rely upon my going it alone here ~~am~~ Emphatically to your heart's content.

GEG

Hurry forward the "new Receiver" all the same—[e]

LS, NjWOE, DF (*TAEM* 19:966). Note form of George Gouraud, preadressed to Edison; note form is electric pen copy. [a]"LONDON," and "1878" preprinted. [b]"meant . . . be" interlined above by Gouraud. [c]Obscured overwritten letters. [d]"as regards Bailey" interlined above by Gouraud. [e]Sentence written by Gouraud.

1. Edison sent his cable on 30 October at 3:50 P.M. The following morning at 9 A.M. he received Gouraud's return cable, "Bravo that speaks infinitely your confidence and justifies any delay we will be all ready for you and alone emphatically." On 11 November, Edison answered this letter by cabling, "Alone emphatically refers to Bailey See your own letter." DF (*TAEM* 19:964, 974).

2. Gouraud had asked for Edison's wishes about cooperating with Bailey on telephone rights in Europe. He reported that Bailey appeared to have entered into an agreement with Puskas and was

> now over here trying the same thing on me and I have given him distinctly to understand the following:—
>
> That if he has a Telephone (he talks now of Phelp's, rather than Gray's) which is independent of Bell's, and independent of batteries, and as good for short lines as *Edison's* and can show me that he can "get as much money for his alone as I can get or want for Edison's:" that if he can persuade me, as he professes to believe himself that by combining we can both get twice as much as otherwise, then of course I will see the desirability of combining with him,

> but I was obliged to tell him that the only experience I have had with his Telephone was when he had told me it was "working perfectly" in London and where it happened that it was in an office of a personal friend of mine where I saw it myself and proved that it did not work at all and my friend in whose office it was, said that it had not worked at all except once or twice a feeble sound came through though no practical conversation.

Gouraud asked Edison to consider Bailey's claims and "advise me fully by letter, and a single word by Cable will be sufficient to know the Essence of your decision. By the word "alone" I will understand that I have "a lone hand" and need not bother myself with him. The word "together" will intimate that he has something and that I shall await your letter." Gouraud to TAE, 18 Oct. 1878, DF (*TAEM* 19:948).

-1542-

Stockton Griffin to Grosvenor Lowrey

[Menlo Park,] Nov 1st [187]8[a]

Confidential

Dear Sir

Upon arriving at the Park yesterday I spoke to Mr Edison regarding our conversation about the Sawyer-Man Electric light, being careful not to say anything beyond what you told me—[1] I was astonished at the manner in which Mr E received the information. He was visibly agitated and said it was the old story—ie, lack of confidence— The same experience which he had had with the telephone, and in fact with all of his successful inventions, was being re-enacted. He also referred to the telephone being loaded down with useless encumbrances and remarked that if he had a voice in the matter the electric light should not be so treated—no combinations, no consolidations for him— I do not feel at liberty to repeat all that he said, but I do feel impelled to respectfully suggest that as little be said to him as possible in regard to the matter. He said it was to be expected that everyone who had been working in this direction, or had any knowledge of the subject, would immediately set up their claims upon ascertaining that his system was likely to be perfect— All this he anticipated but had no fears of the result knowing ~~this~~ that the line he was developing was entirely original and out of the rut.

I was careful to say to him that as far as you were concerned there was no lack of confidence but that perhaps this element could be found in Mr Edson and others. He will no doubt give you his views in full so I will abstain from saying more at present but will try and find time to call on you the next time I visit the City and say more on the subject as I consider it somewhat serious. Very Truly

S. L. Griffin

ALS (letterpress copy), NjWOE, Lbk. 3:467 (*TAEM* 28:893). [a]Circled "c" written at top.

1. The same day (31 October), Lowrey had written Edison, "I was glad to receive your note of today, in which you say that Sawyers patents do not touch yours. Of course we are not to expect to escape without some trouble: but at the same time a competitor who boldly claims even that which is false, is able to produce a good deal of effect upon the monied value of any business or invention. We therefore must be prepared for Mr Sawyer." This marked a change from Lowrey's letter to Albon Man of 30 October in which he had written "I understand that you have what is apparently to me a very good light, and even if we were able to sustain both rival patents we should be competitors in business, which itself would be commercially a great mistake." He also suggested that they "be represented by the same strong banking house or houses" in regard to foreign business. Not surprisingly, Man had seen this letter as an overture to a merger of the two companies, but on 2 November, Lowrey replied,

> I was surprised this morning to hear that my letter to you was spoken of as an advance towards a consolidation of our company with yours. I am sure you cannot have made such a mistake. At any rate, if such an impression was derived from what I wrote, there was no such specific purpose in my mind, and I desire to correct it now and to add that I have not the slightest idea that the Edison Electric Light Co. would entertain any such proposition from you, and certainly they would not make it.

Lowrey to TAE, 30 Oct. 1878, DF (*TAEM* 18:56); Lowrey to Man, 30 Oct. and 2 Nov. 1878; Man to Lowrey, 31 Oct. 1878, complainant's exhibits, pp. 964–67, 971, *Sawyer & Man v. Edison (U.S.)* (*TAEM* 47:293–94, 296).

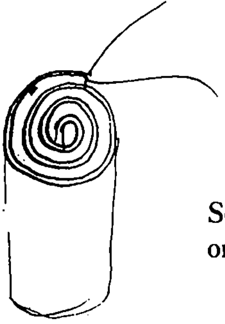
-1543-

Technical Note: Electric Lighting

[Menlo Park,] Nov 1 1878

Electric Light

Batch get 4 large say 10 gallon crocks for secondary batteries. & get some sheet lead[a] 1/16~~th~~ thick & foot or foot & ½ wide. wind thus



Seperate by solid soft rubber this size ○ or strips 1/16 thick of gum rubber cloth.

Try platinized Carbon see Watts Dic[1]—page 762, under "Carbon"[2]

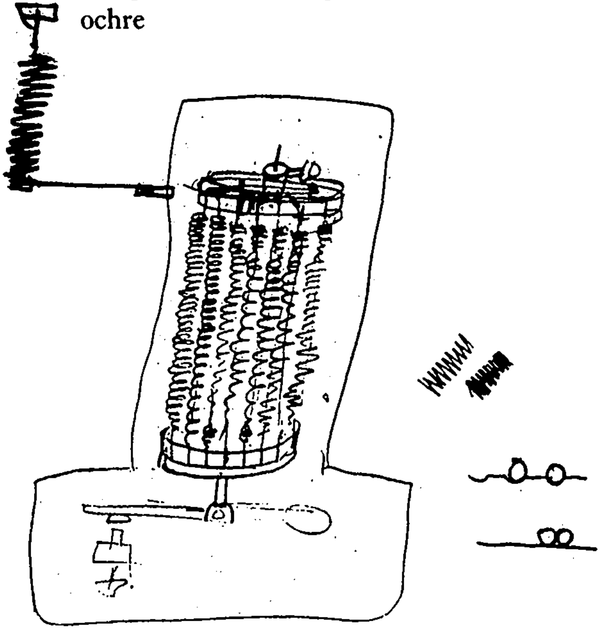
Boron combines with platinum. Try alloys of Boron & ~~Palt~~ Platinum, or Iridium—Silicum & Plat etc all the infusible metals one with the other Boron unites easily with plat. See watts Dic "Boron" page 629

Alloy of platinum & Cadmium "100 parts of platinum at a red heat retain 117.3 parts Cadmium. The alloy is almost silver white—very brittle, very fine grained & refractory in the fire"[b] Watts "under "Cadmium" page 703[c]

Is oxide of Ruthinum a Conductor if so if cannot be melted by the electric arc

Get some Pitchblende

Eh!— Tungsten alloy with iron— "Iron is the only metal which alloys with tungsten in all proportions up to 80 per cent of the latter with which proportion a mass is formed not fusible[d] at any attainable temperature" pag 898 Wats Dic Tungsten Get Tungstic oxide, ie[e] Wolframine or wolfram ochre



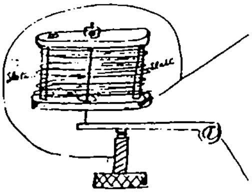
Batch make drawing of this 20 spirals finest platina wire, twice the length of those in the other lamp[3]

TAE Chas Batchelor
M N Force J Kruesi
Geo E Carman Wm Carman

X, NjWOE, Lab., Vol. 16:172, 200, 173 (*TAEM* 4:618, 643, 619). Document multiply signed and dated. [a]Obscured overwritten letters. [b]"in the fire" underlined twice. [c]Followed by centered horizontal line. [d]"not fusible" underlined twice. [e]Circled.

1. Watts 1875 was a commonly used reference work at the Menlo Park laboratory. There is a copy with the Menlo Park laboratory stamp in the chemistry laboratory at the Edison National Historic Site. Another set of notes from around this time that refers to Watts is in Vol. 16:417–19, Lab. (*TAEM* 4:852–54).

2. Edison's notes were copied by Batchelor into a notebook that was later disbound. To this point they are included in the series of notes that Batchelor began on 22 October (Doc. 1491). The remainder of the notes Batchelor dated 1 November. Vol. 16:154–55, 176–78, Lab. (*TAEM* 4:604–6, 622–24).



Charles Batchelor's 1 November version of a wrapped-slate lamp design.

3. The following day Edison drew several other versions of this design (Vol. 16:183–85, 186, Lab. [*TAEM* 4:628–29, 631]). Batchelor's version of the 1 November notes (see note 2) also includes another lamp design for which Edison's original note has not been found. He instructed John Kruesi to "Make an instrument like this:— Platina wire wrapped round two pillars of slate and regulator wire through middle as in sketch the wires in passing backwards and forwards come close to wire & each other to take the effect of radiation" (Vol. 16:178, Lab. [*TAEM* 4:624]). On 2 November, Batchelor prepared a measured drawing of this design and on 4 November, Edison made drawings of similar designs and headed them "Model patent office" (Vol. 16:189, 193, Lab. [*TAEM* 4:632, 636]). It is not known if Edison applied for such a patent; none issued.

-1544-

From William Barrett

[Dublin,] Nov. 2. 1878

My dear Sir,

The London "Times" having authorized me to send them the earliest reports of your electric light discovery, I should feel greatly obliged if you would send me a cable message reporting progress, that I might publish in that paper. Of course all[a] expenses will be paid at this end. I need not tell you what a wild commotion throughout England & Ireland has been created by your discovery, ~~had not~~ which your Mr Adams gave me to announce at my Birmingham lecture, and I should feel it a personal favour if you would enable me to give the Times the earliest information on the principles of your discovery or of the progress you have so far made Just now you are the best known man in Great Britain & a long article on your tasimeter in the 'Times' has been copied everywhere. I am sending that leading Journal a letter on your tasimeter which will appear in a day or two, a copy will be sent you.[1] With many congratulations Yours very truly

W. F. Barrett

Let me have your[b] 'carte' when convenient[b] if you have no objection. ~~to a photo~~

⟨will try do what you say hard put at bldg will be 3 or 4 wks⟩[2]

ALS, NjWOE, DF (*TAEM* 17:217). [a]Underlined twice. [b]Obscured overwritten letters.

1. The London *Times* had published an article on "Edison's Tasimeter" on 29 October. In a 1 November letter to the *Times* (published on the 5th), Barrett asserted that the carbon telephone, carbon rheostat, and micro-tasimeter all "depend upon the principle, which Edison, I think, was unquestionably the first to discover," of the variable resistance of fine carbon particles under pressure. Barrett also claimed that Edison "was familiar with the true principle of the microphone long before this exquisitely sensitive toy, for as yet it is little more, was made known by Professor Hughes." He conceded that as Edison "in his eagerness to press forward, has published no account of the multitude of experiments that have led up to his many and valuable inventions, Professor Hughes is entitled to all the credit of having independently discovered and first published the simple and novel arrangement" of the microphone. "Edison's Tasimeter," *Times,* (London) 29 Oct. 1878, Cat. 1241, item 1004, Batchelor (*TAEM* 94:407]); "The Tasimeter," ibid., 5 Nov. 1878, 4.

2. Stockton Griffin noted that Edison's answer was sent on 15 November. Whether for an article in the *Times* or for his lectures, Barrett subsequently commenced a cable correspondence with Edison regarding his electric light system. See Doc. 1587 n. 5.

-1545-

From Edwin Fox

New York Nov. 2 1878

My dear Chevalier;

I have pledged my sacred honor to the Herald[a] to have ready for them by Friday next that Biographical sketch of your Royal Highness, and as it would be only proper to have an occasional fact in the article it will be necessary for me to see you before then. I cant get away to go to Menlo Park as I must be in Court a portion of every day during the week, so I must rely on my chance of catching you in New York.

Will you therefore, my cherished member of the Legion of Honor, telegraph me at once what day you will be in and what time and where I can see you for a half hour?

It is as necessary to sit for your biographer you know as it is to sit for your sculptor or painter. Each must have the model before him to do justice to the subject

Hoping therefore to hear from you Monday[1] I remain As ever Yours

Ed. M. Fox

PS. I am solemnly charged by my better half to express to you her sincere appreciation of the courtesy shown her this PM. in her visit to the laboratory. She thinks that that new "12 pound phonograph" is immense. E.M.F.

ALS, NjWOE, DF (*TAEM* 17:219). [a]Underlined twice.

1. Edison replied on 4 November that he would answer Fox's questions. The following day Fox sent him a letter discussing what he wanted to include in the biographical sketch:

> What the Herald wants is a vivid, succinct, tierce, graphic sketch not only of your past life but of all the minor incidents of the present—how you act, talk, live, work and look—the struggles and obstacles attending the completion of your chief inventions—your method of classification— your system of detail etc. etc.—the whole going to make up a lively and interesting pen picture.

Fox felt that to write such a sketch it would be "necessary for me to leave all other business for, at least, a week, and taking up a habitation near the laboratory . . . place myself in such a position that when the spirit moves I may drop in upon you." He therefore asked Edison for information about room and board at Menlo Park. On 6 November, Stockton Griffin wrote to ask Fox "if he couldnt put it off till next week." On 20 November, Fox apparently received a letter from Edison inviting him down and made plans to go to the laboratory the next day. Fox to TAE, 5 Nov. 1878, Fox to Griffin, 20 Nov. 1878, both DF (*TAEM* 17:223; 16:458).

The biographical sketch never appeared. However, on 22 November the *New York Herald* published an article on "The Electric Light" (p. 4) in which Edison denied rumors that the Patent Office had rejected one of his applications.

> I know absolutely that my invention is new. Why for the past two weeks I have had an expert searching the books of the Astor Library, and making a digest of all patents and claims on the subject of electric lights, and he has found nothing bearing the slightest resemblance to mine. This is outside of the usual examination in the Patent Office. If my invention is not new I don't want a patent for it, but if it is new, and I know that it is, the patent must be issued. On that point the law is imperative. It can't be got around. No, I have no fear—not the first particle.

The expert was Francis Upton (see Doc. 1610). The *Herald* went on to say that Edison had overcome all difficulties except "minor details" and would "very soon" give a public demonstration of his lighting system. Fox continued to seek additional information from Edison and, on 27 November, telegraphed his editor from Menlo Park that he would "not have anything tonight obliged to remain over all night." The *Herald* did not carry another report on Edison's light until early December (Fox to James Gordon Bennett, 27 Nov. 1878, DF [*TAEM* 17:256]).

-1546-

From Grosvenor Lowrey

New York, Nov 2nd 1878[a]

My dear Edison:

I am just now very much occupied in the matter of a case in Washington which will take me on again tomorrow, and therefore have not much to write you. I only want to say one thing to you emphatically. Do not give your-self the slightest uneasiness from any-thing you hear from me or any-body else, about other people's efforts, or inventions concerning electric light. My confidence in you as an infallible, certain man of science is absolutely complete: and whatever it may be necessary to say in talking with businessmen, who of course are liable to be misled, but who on the whole generally come right and do not make mistakes, you may be sure that the party which has been made up has put in their money in absolute confidence in you and nobody else. Very truly

G. P. Lowrey

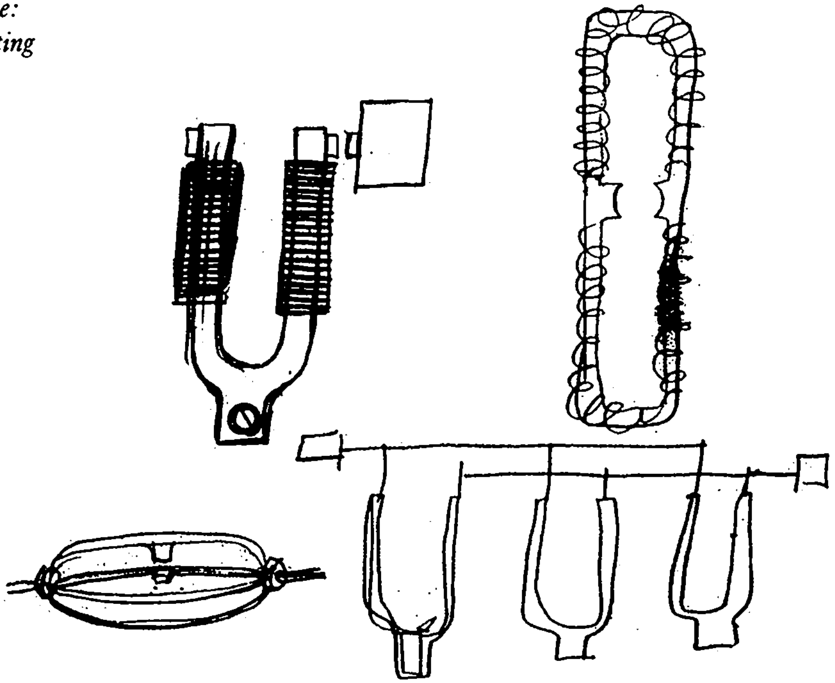
LS, NjWOE, DF (*TAEM* 18:59). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted.

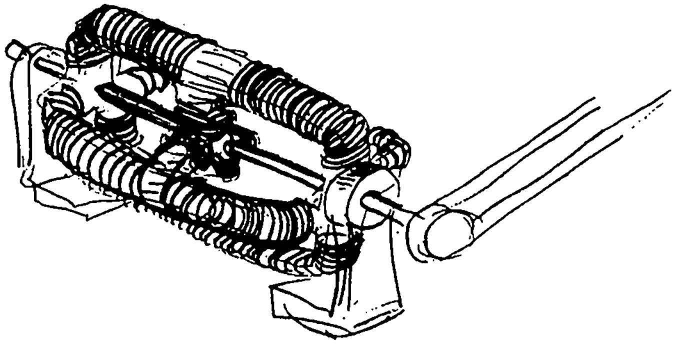
-1547-

Technical Note: Electric Lighting

[Menlo Park,] Nov 2 1878[1]

Electric Light Magnetos—[2]



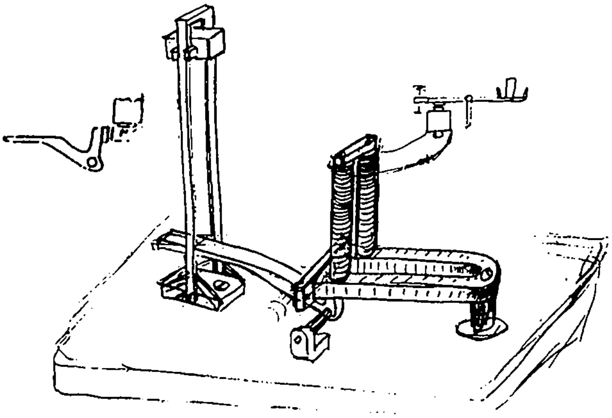


TAE	Chas Batchelor
M. N Force	J Kruesi
Wm Carman	G E Carman

X, NjWOE, Lab., Vol. 16:187, 186 (*TAEM* 4:630). Document multiply signed and dated

1. The same day Edison drew what appears to be a dynamometer. He drew an alternative design nine days later. Vol. 16:182, 248, 250, Lab. (*TAEM* 4:628, 688, 690).

One of Edison's designs for a dynamometer.

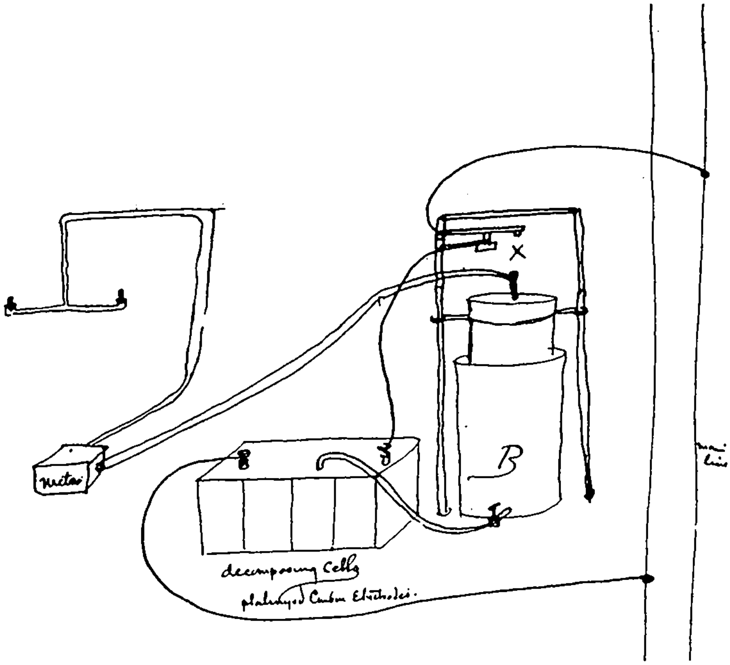


2. Two of these drawings represent Edison's continuing work on tuning fork dynamos. The other three represent his first efforts to design an electromagnetic generator in a more standard form. In this design an armature in the form of a cross revolves between the poles of the field magnets. During the first week of November he made additional drawings and considered several points of inefficiency in generator design. Vol. 16:201, 215–16, Lab. (*TAEM* 4:644, 658–59).

-1548-

[Menlo Park,] Nov 2 1878[1]

Technical Note: Electrochemical Gas Lighting



When the gasometer is full the cylinder that rises lifts the lever at X from its contact point and opens the circuit. If now the gas is lit in the house the cylinder falls & closes the circuit and the current gives more gas; The gas burner may be either a fine capilliary tube with the jet playing against lime Zirconium oxide etc or it may permeate through cylinders of that substance, or a plug of finely divided moulded Iridium or platinum[a] may be used it permeating through that ~~subs~~ the Iridium helps to set it on fire by catalytic action and at the same time the iridium plug becomes incandescent. to prevent explosion the gas may pass through gauze or ~~wire~~ fine wires laid longitudinally in tubes=

This method I call lighting by Electrolysis=[2]

T A Edison — Chas Batchelor
M N Force — J Kruesi
Wm Carman

X, NjWOE, Lab., Vol. 16:181 (*TAEM* 4:627). [a]Obscured overwritten letters.

[1] Text labels in the drawing from left to right are "meter," "decomposing cells platinized carbon electrodes," and "main line."

[2] On 6 November, Edison described an alternative method for electric lighting by electrolysis: "Decompose water into oxygen & hydro-

gen these gases impinge upon a platinum sponge or foil or cylinder and are ignited by the catalytic action of the platina. This power may be assisted by passing a current through the platinum." Vol. 16:202, 210, Lab. (*TAEM* 4:645, 653).

-1549-

From George Barker

Philada. Nov. 3, 1878.

My dear Edison:—

Your letter of yesterday is at hand.[1] The letter you enclose is all "stuff" & is purely fanciful, existing only in the imagination of the writer. I return it herewith.

I also enclose to you a proof of your tasimeter article,[2] as I fixed it up. Please read it as soon as possible and communicate to me any changes or corrections you want made, so that I can put them on the proof I am to return to Putnam. Can you get for me a set of the electrotypes for this article for the Am. J. Sci? I shall send this article there for the Dec. no. & they may not like to wait till Putnam gets through with the electros. he has. As I have heard nothing from you about the ~~tasimeter~~ voltameter[a] article, I have sent the proof back to Putnam with the corrections I noted on your proof.[3]

You have not noticed my letter of Oct. 23d.[4] Mr. Griffin wrote me that you were sick in bed with neuralgia, and so I supposed that was the reason. I hope you are better again by this time. But this attack should be a warning to you that nature will not always be trifled with. You work too hard and too irregularly: Have more system about your work and you could do the same amount you now do without the danger. Be regular about your meals and sleeping hours; or some day you will break down entirely.

What I particularly want to know is whether I am to have one or two of your burners for my lecture? Under the circumstances, you will place me in a terribly awkward fix after promising them to me, if you dont let me have them. Have you found a "bug" in the light, which is the reason why you dont want me to show it? Be frank with me and tell me exactly what is the fact. May I not, if worse comes to worse, make a lamp to exhibit, like the one you showed me? Anything to relieve me of my embarassment before the audience. I hope you and Bachelor will be able to come on to the lecture.

The National Academy meets in the Chapel of Columbia College on Tuesday next and continues in session two or three days. If you have the time, I should be glad to see you there.

If you have any curious things to show I am sure the Academy would be glad to see them.

What about the new light of Sawyer & Man that the N.Y. papers are talking about? It seems to be the lamp proposed by the Russian engineer Ladiguin,[5] revamped. How does it work? I have not taken much stock in it.

I shall try to induce Draper to take a run over to see you some day this week. Cordially yours

George F. Barker.

ALS, NjWOE, DF (*TAEM* 16:379). [a]Interlined above.

1. Not found. The letter Edison had enclosed and which Barker returned is unidentified.

2. Doc. 1401.

3. This article is Doc. 1382. The proof pages are in Cat. 1241, item 1074, Batchelor (*TAEM* 94:438–40).

4. Doc. 1519.

5. Both the Sawyer and Man lamp and Alexander Lodiguine's design used carbon rods in a glass tube filled with nitrogen or other inert gases. Dredge 1882–85, 1:546.

-1550-

From Lemuel Serrell

New York, Nov 4th 1878.[a]

My Dear Sir

I send copy Sawyers patent as desired—[1]

The copies of the electric light patents and magneto electric machine patents have all been selected from the books and ordered

The Patent Office has referred on your electric light to the English patent No 12 278, this is evidently a mistake as no such patent is among "Electricity." No 12 287 is an electric "thermometer" and has nothing to do with your light. I have written for information

The powers of atty, France were with my agent in Paris Octo 22. Puskas has seen them and says they are all right and he said the cash was forthcoming

Your continental and English light papers are going on all right: your English provisional was lodged 23d Octo:

Brewer writes that on 22d the London times stated "that you, Edisons Agent had sent to your London correspondents this document, which we only received this morning"— By this you will see how you are watched, and that the London papers had knowledge that I had sent the papers, the day before they were received by Brewer. The precautions taken have not been unnecessary.—

The batch of cases for you will be sent down in a day or two— Yours truly

Lemuel W. Serrell

ALS, NjWOE, DF (*TAEM* 18:779). Letterhead of Lemuel Serrell. [a]"New York," and "187" preprinted.

1. Not found. This was probably the first Sawyer-Man incandescent lamp patent (U.S. Pat. 205,144).

-1551-

From George Gouraud

London, 5 Novr 1878[a]

My dear Edison.

Light

I am still without any advices from New York in reply to my $150 cable message.[1] I have no doubt you have done your part and infer that the matter is under consideration and that in due course I will hear. Meanwhile however the demand for Electric Light from what I may call "Consumers" continues[b] to show itself by constant receipt of letters and besides we hear more and more of other subdividing inventions from which, however, I take no special[b] alarm. ~~for~~[c] but[d] there is no doubt that we[d] ~~will~~ would if first in the field[c] be immeasurably[b] strengthened as against any possible competitors through the accident of anybody's having fallen upon your idea or anything approximating thereto, and getting the start of it through earlier Patents.

I confess I am more concerned than anything about my personal status in this business but as to this I must patiently wait for your explanations. I have no fear that you have taken care of me as you intimate but what I am most anxious to do is to be as little hampered as possible in the negotiations here. By the way you may not have forgotten our conversation last Spring on the subject of Electric Light when I urged you to take it up and you then told me you would not do it, "so many others were working in that field." If the urgency of my views as to the importance of the subject as then expressed to you had any influence in your really finally taking up the subject I shall feel a sense of special satisfaction. I have been urged to take a Seat on the Board of the Rapieff Company but declined to do so for obvious reasons though they are going on with their organisation and mean to occupy the field as far as they can but assure me that nothing that they do will in any wise hinder their combining with us whenever we are ready on the basis as already laid before you. Meanwhile also the Wall~~is~~ace[d] people are anxious to co-operate with us here in fact this office seems to be the focus for all the Lights. I am just now going to "The Times" building to see the Rapieff. This fellow Werdermann's light is being a good deal talked about.

Telephone

I had a visit yesterday from McClure[2] the Manager of Bell's Company who, you may remember wrote you. He seems very much exasperated; says Professor Barrett's Lecture[3] and the extent to which your Telephone has been shown already has done them very great damage. I think there is very little doubt about that as I know so many instances where people wish to have yours not only in cases where they now have none but in as number of instances where they already have Bells and find them "not satisfactor~~il~~y." McClure says the company's action will be brought as speedily as possible and carried to the bitter end; the Directors are very wealthy gentlemen and they mean to prove either that their patent is good, and enjoy it, or that it is worthless and burn it up— He seemed a little bit staggered when I told him something of the "new Receiver" but threw himself back on "damages already incurred" by the use of their Receiver which he knows to have been shown in Birmingham and to be now in process of manufacture by several Manufacturers." The advice of all concerned here is that we should do nothing further until your new receiver comes so pray hurry it along! Meanwhile the preliminaries are all arranged with several companies for large commercial centres and as soon as the new Receiver can be employed the papers will be put through and you will have some considerable cheques to the credit of your Bank account. My plan of separate companies in different places is generally approved of. The London Company will have not only the business of London but wherever else business can be done in districts not the subject of special licenses. If you would cable a word indicating that the new Receivers are shipped it would be a very great gratification to me. The simple word "Receiver" will suffice and will indicate that it is shipped on a vessel that sails from New York on the day the cable is sent. Yours very truly[4]

Geo. E Gouraud

P.S. A partner of Ladd[5] who is agent for Wallace's[b] machines here, told me today that he has made a Receiver for Preece which Preece tells him is entirely independent of Bells in every way and far surpasses it in efficiency when combined with your transmitter: that this is the thing which he has patented but that he had intended always to give it to you as a means of securing your independence of Bell!!! I replied that "it is a pity he had not done it sooner as you had yourself since invented a Receiver" &c &c GEG

LS, NjWOE, DF (*TAEM* 16:394). Note form of George Gouraud; note form is electric pen copy. [a]"LONDON," and "1878" preprinted. [b]Obscured overwritten letters. [c]Canceled [d]Interlined above. [e]"would . . . field" interlined above.

1. On 26 October, Gouraud sent a cable message to Lowrey. He then enclosed a copy of that cable and another to Edison (asking him to see Lowrey on his behalf) in a letter of the same date. The copy of the cable to Lowrey does not show Lowrey's address and it is unclear if it was received. In it Gouraud urged the formation of an Edison electric light company and asked that his role be defined in relation to electric lighting in Britain. DF (*TAEM* 18:166–71).

2. Little is known of J. H. McClure. Bruce 1973 (p. 245) does not give a first name and notes only that the temporary secretary of the company, Adam Scott, charged McClure with ineptitude and slovenly ethics and accused him of trying to cheat the company. Bell resigned as director of the company in mid-October because of "the gross mismanagement of the Company's business and the personal discourtesy with which I have been treated by the Board of Directors and by the Acting Manager." McClure was soon replaced by William Reynolds. No letter to Edison has been found, but there is a copy of a letter from James Adams to McClure regarding the Bell Company's threatened injunction against the London manufacturers of Edison's telephone (12 Oct. 1878, DF [*TAEM* 19:940]).

3. This lecture was probably close in content to the series of three articles Barrett published in *Nature* at this time. Barrett 1878d.

4. No cable has been found. On 18 November, Edison wrote Gouraud, "I want to do a little more work on the New receivers they must be perfect when they leave my hands. I expect to send my nephew (Chas Edison) with them as he thoroughly understands the mechanical details. I cannot say definitely when he will go but it will be soon." He indicated, however, that he was sending nineteen Western Electric transmitters, along with twenty induction coils and six half-pint bottles of carbon, "pressed and sifted, ready to make into buttons." Lbk. 4:7 (*TAEM* 80:19).

5. William Ladd was a noted scientific instrument manufacturer who had introduced a dynamo design in 1867. Nothing is known of his partner. de Clercq 1985, 59, 63–64, 66–67, 69, 89–90, 202; King 1962c, 375–76, 379.

-1552-

William Thomson to William Preece

Glasgow.[a] November 5th 1878

Dear Preece,

I am sorry Edison has not written to you. I had some hope that he would do so in a handsome manly way. There is no doubt he is an exceedingly ingenious inventor, and I should have thought that he had it in him to rise above the deleterious influence of the kind of puffing of which there has been so much.

Thanks for Mr Blake's[1] letter. I remain, Yours truly,

William Thomson

LS, UkLIEE, WHP. Letterhead of University of Glasgow. [a]Preprinted.

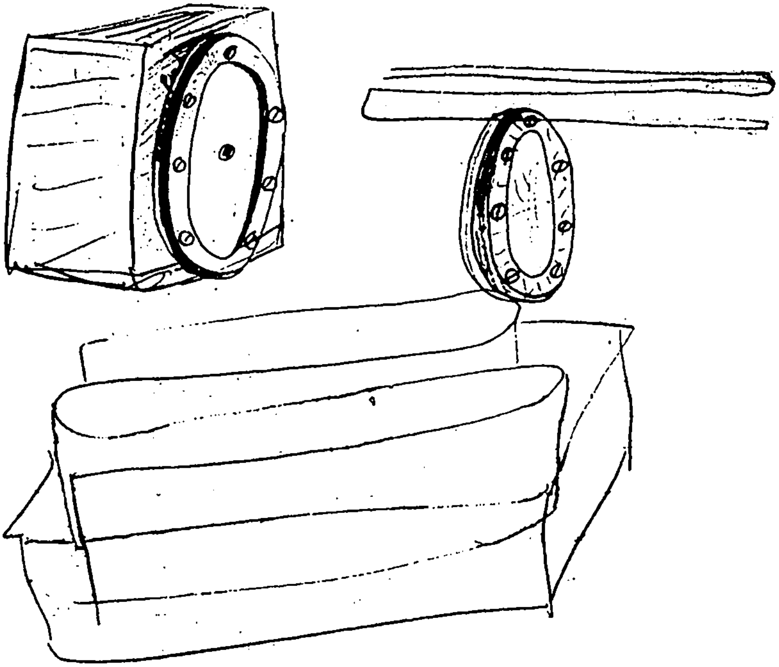
[1] Unidentified.

-1553-

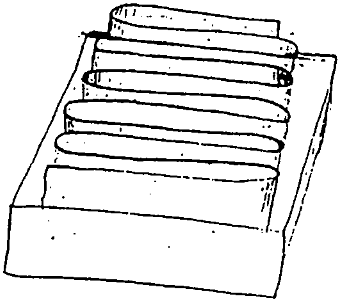
Technical Note: Telephony

[Menlo Park,] Nov 5th. 1878

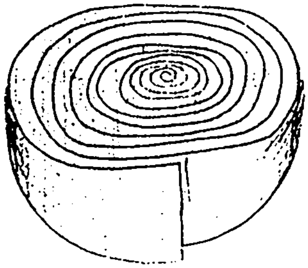
New Receiver—



Discts of Blotting pads— 2 thickness—inserted between the diaphram and the box—to prevent the conductiveity of the viberations of the diaphragm to the wooden Box—[a]



strip Blotting pad Laid in zigzags in a can of water for moist~~ing~~ening the chalk—



The following course of Experiments with differant pressures given to the buttons—[b]

6–30—No 1 =[1] Very Light pressure, to soft, busted before trying it—[b]

6–30—No 1— Light pressure—

6–30—No 1— Heavy pressure—in box no 6—works bang up, I think better articulation than any her~~t~~etofore—Left in for permanency[c]—[b]

6–30—No 1— Very heavy pressure—in box no 5 Just as good as the above— Left in for permanency[b]

6–30—No 1— ~~m~~[——][d] moderate[e] pressure—

TAE Chas P Edison
Chas Batchelor J Kruesi
M N Force

X, NjWOE, Lab., Vol. 18:77 (*TAEM* 4:1111). Written by Charles Edison; document multiply signed and dated. [a]Paragraph overwritten by drawing. [b]Followed by centered horizontal line. [c]Obscured overwritten letter. [d]Canceled. [e]Interlined above.

1. See Doc. 1529 n. 1.

–1554–

From Lemuel Serrell

New York, Nov. 6 1878[a]

My Dear Sir

Brewer & Jensen write under date 25 Octo. that Col. Gouraud requested them to see him and pursuant to his request have handed a general retainer to Theodore Aston,[1] Q[ueen's]. C[ouncil]. their greatest patent lawyer as a general retainer in your behalf

They are very desirous of your keeping publications out of the papers &c describing your improvements.[2] The excitement about your improvements they say is truly marvelous—

They say they understand that Col. Gouraud has the working of the patent and they will render him any aid in the matter they can in the event that I do not instruct them to the contrary—

How is this, what is Gourauds position? Yours truly

Lemuel W. Serrell

ALS, NjWOE, DF (*TAEM* 18:784). Letterhead of Lemuel Serrell. [a]"New York," and "187" preprinted.

[1] On 26 October, Gouraud wrote Edison that he had retained Aston in order "to preclude the possibility of his falling into the hands of anybody else" and described him as "at the very head of his profession in England as regards Patent Laws and has no rival." DF (*TAEM* 18:174).

[2] The same day, Serrell wrote Grosvenor Lowrey to say that all publication about Edison's light should be suspended until the patent opposition stage had passed, about three weeks. Lowrey then sent a copy of this letter to Edison and asked Edison "to communicate to your friends the reporters a wish that they should say nothing more about your light whatever." DF (*TAEM* 18:61–62).

–1555–

Memorandum: Telegraph Conversation

Menlo Park, N.J., [November 6,][1] 187[8][a]

Conversation with Serrell 8 P.M.[2]

To Serrell Plainfield— Can we cable a provisional specification to England? Edison[b]

Edison Yes, but expensive. It could not be filed except as a communication— Serrell[b]

To Serrell Will it be safe for Brewer to make the communication Edison

To Edison Yes Serrell[b]

To Serrell The following is the Cable that I propose to send=

To Brewer & Jensen Chancery Lane London

File the following provisional and apply for great seal immediately

Improvements in Conductors for Electric lighting which may be brought to incandescence by the passage of the current—

I mould finely divided iridium platinum Ruthinium or other metals that have high melting points in the form of cylinders plates and other forms and pass currents of electricity through the same to render them incandescent.

Another part of my invention consists in varying the resistance of such cylinders by mixing with such finely divided metals non-conductors which are with difficulty fusible, such as magnesium or Zircon oxides Edison

To Edison Except the last 20 or 30 words you are already covered by your papers that have been sent Serrell[c]

To Serrell That is the important part of it Please put it in shape and send it back to me in the proper form for transmission Edison

Serrells form of Cable ⟨(which was sent to London at 9:40 P.M.)⟩[d]

Brewer and Jensen Chancery Lane London

Enter provisional and seal immediately as a communication from Edison.

Improvements in lighting by Electricity. The light giving material is in the form of cylinders or prisms of finely divided metals such as platinum, Iridium, Ruthinium or other material having a high melting point mixed with non conductors such as magnesium or Zircon oxides that are with difficulty melted. These are mixed and compressed into the proper form for the light and rendered luminous and incandescent by the passage of the electric current[3] Serrell

To Serrell You telegraphed today for me to look at English patent no 12 276. Do not understand

Numbers do not run that high. What year is it in, whose patent is it? Edison[b]

Edison About 1849 under old law I do not remember name Serrell

To Serrell Does it say anything about regulation by expansion E

Edison There is a regulation of the distance of the Carbon points but I did not have time to examine the account fully Saw nothing about expansion

I thought you had the full published specifications

I have a book with specifications and drawings send to my office for it tomorrow[4] Serrell

[To Serrell:] Good night[e]

D, NjWOE, DF (*TAEM* 18:788). Written by Stockton Griffin; letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted. [b]Followed by line across page. [c]Followed by centered horizontal line. [d]Interlined later by Griffin. [e]"Good night" written between two heavy parallel lines, probably by Edison.

1. A telegram dated 6 November and sent at 7:10 P.M. from Edison to Lemuel Serrell at his home in Plainfield, N.J., reads: "Come to Telegraph office after supper will have wires put through from here to Plainfield wish to speak to you very important. reply immediately if you will be there and what time." DF (*TAEM* 18:788).

2. Edison described this conversation in an interview that appeared in the 25 November *New York Sun,* though he was mistaken concerning when it occurred.

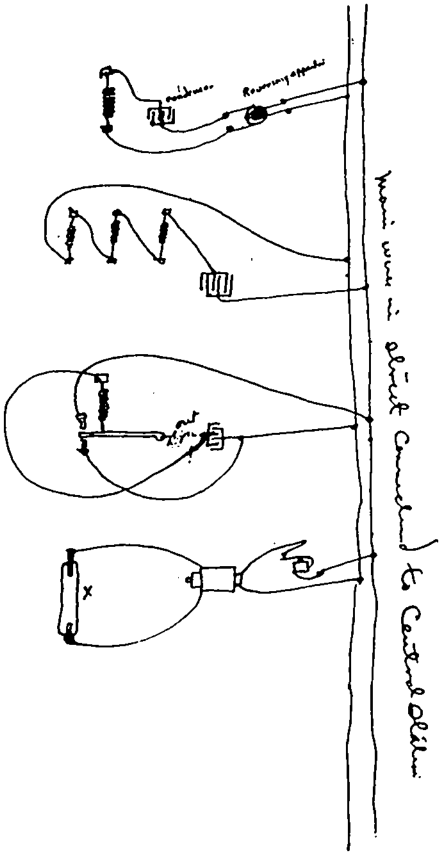
> Last week I made a discovery at 4 o'clock in the afternoon. I got a wire from here to Plainfield, where my solicitor lives, and brought him into the telegraph office at that place. I wired him my discovery. He drew up the specifications on the spot, and about 9 o'clock that night cabled an application for a patent to London. Before I was out of bed the next morning I received word from London that my application had been filed in the English Patent Office. ["The New Electric Lights," Cat. 1241, item 1021, Batchelor (*TAEM* 94:416)]

3. This paragraph became Edison's British Provisional Specification (filed 7 November by Edward Brewer), which issued on 7 May 1879 as British Patent 4,502 (1878). He filed a U.S. application on this design on 9 December, which issued the following September as U.S. Patent 219,628.

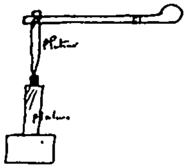
4. Edison obtained the volume from Serrell the next day and wired him "No conflict with my system it relates solely to regulation of carbon." TAE to Serrell 7 Nov. 1878; Serrell to TAE, 7 Nov. 1878; both DF (*TAEM* 18:792).

Technical Note: Electric Lighting

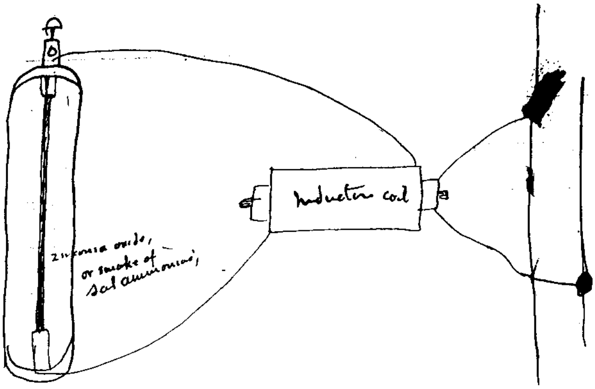
Caveat No 6.[1]


condenser
Regulating apparatus
main wire in street connected to Central Station
cut
x

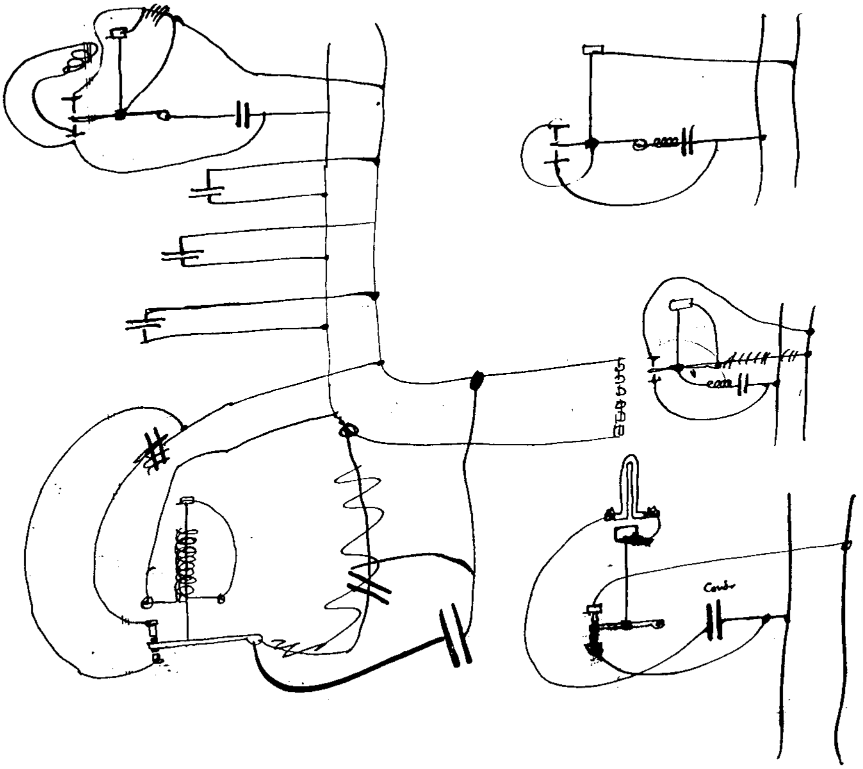
X tube filed with smoke such as sal ammoniac smoke. jump spark in vacua makes smoke incandescent. a stick of finely divided Conductor mixed with large quantity of non conductor[2] may be used in tube & quantity jump spark used =


Platina
platina

Moulded iridium or even solid platina.[3]

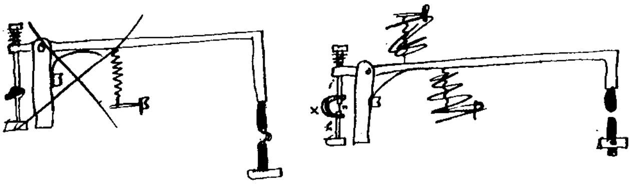

Induction coil
zirconia oxide,
or smoke of
sal ammoniac,

Vibrated main station;[4] or

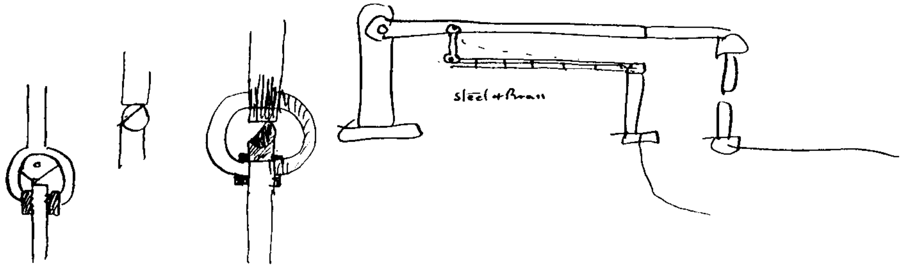


Use of Condensers— for sub dividing[5]
Principle.

Fig 7



X insulator n a small peice of metal which ~~may bi~~ heats by Not making good con~~d~~tact[a] This heat is communicated[b] to the rods h. i. and expands this seperates the carbon electrodes and if the arc is broken the rod i. h. cool & allow the carbons to touch again. He has a knife edge arrangement to adjust the heating of n.[6]



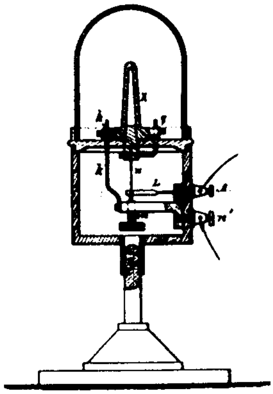
TAE
M N Force

Chas Batchelor
J Kruesi
Wm Carman

X, NjWOE, Lab., Vol. 16:205, 207–8 (*TAEM* 4:649, 651–52). Document multiply signed and dated. [a]"good con~~d~~tact" underlined twice. [b]Underlined twice.

1. This caveat was never drawn up or filed. Text for the top circuit is "condenser" and "Reversing appartus." On the third circuit Edison wrote "out," meaning delete the wire drawn between the lever and the condenser. Along the right side the text is "Main wires in street connected to Central Station."

2. The use of finely divided conductors in combination with a nonconductor became the subject of Edison's U.S. Patent 219,628 and British Patent 4,502 (1878), the provisional specification of which Edison had discussed with Serrell via telegraph the same day (see Doc. 1555). In the U.S. patent he noted that "the use of a non-conducting material is not absolutely necessary, as the finely-divided metals, owing to their porosity, have high resistance, and become easily incandescent." The high resistance of this lamp design allowed him to use a "comparatively small electric current."



Edison's lamp design in U.S. Patent 219,628.

3. This refers to the square block in the center between the pieces labeled "Platina."

4. Text above is "Zirconia oxide, or smoke of Sal Ammoniac," and "Induction coil."

5. Text above is "Condr"; the form of burner in the figure with that label is similar to that shown in Edison's U.S. Pat. 219,628. What appear to be related sketches are in Vol. 16:197, 211–12, 217, 222, Lab. (*TAEM* 4:639, 654–55, 660, 663).

To this point, Edison appears to be designing lamp arrangements for use with alternating rather than direct current. The drawings that follow are for an arc light regulator.

6. Text below is "steel & Brass".

-1557-

Technical Note: Electric Lighting

[Menlo Park,] Nov 6. 1878

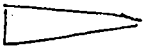
Electric Light[1a]
6 spirals 3′ = 1 spiral of 8′
try it
3′ wire = 7.0686 area

$$\begin{array}{r} 6 \\ \hline 42.4116 \end{array}$$[b]

7.35 = 42.42
8″ wi = 50.2656

41.85—7.3
42.42 7.35
43.00 7.4

6 of 3 = ~~w~~



$$2 = \sqrt{3.^2 + 3^2} = \sqrt{9 + 9} = \sqrt{18} = 4.24$$
$$4 = \sqrt{4.24^2 + 4.24^2} = \sqrt{17.97 + 17.97} = \sqrt{\cancel{35.94}36} = 6.$$
$$6 = \sqrt{6.^2 + 4.24^2} = \sqrt{36 + 1\cancel{7}8} = \sqrt{54} = 7.34$$

$$\begin{array}{r} .7854 \\ .6 \\ \hline 4.7124 \end{array} \qquad \begin{array}{r} .7854 \\ 4 \\ \hline .31416 \end{array}$$

4.712 2.40

$$\frac{1}{8} = \frac{9}{16} =$$

$$\begin{array}{r} .012272 \\ 6 \\ \hline .073632 \end{array}$$

$$\begin{array}{r} .125 \\ 8 \\ 1000 \end{array} \qquad .125$$

6 spirals .0053 = 1 spiral of .008

m.

$$2 = \sqrt{3.25^2 + 3.25^2} = \sqrt{10.56 + 10.56} = \sqrt{21.12} = 4.60$$
$$4 = \sqrt{4.60^2 + 4.60^2} = \sqrt{21.16 + 21.16} = \sqrt{42.32} = 6.50$$
$$6 = \sqrt{6.50^2 + 4.60^2} = \sqrt{41.25 + 21.16} = \sqrt{62.41} = 7.90$$

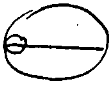
nearly $\frac{8}{1000}$ =

$$\frac{1}{16}$$

$\frac{1}{16}$ wire = how many .005

8¼

16 | $\underline{1000}$
63
63



6 = .12
6 = 12¼ $\sqrt{12.25^2 + 12.25^2} = \sqrt{150 + 150} = \sqrt{300} = 17.32$
12 = 17.32 $\sqrt{17.3^2 + 17.3^2} = \sqrt{299.30 + 299.30} = 598$
24 24.45 $\sqrt{24.45^{2c} + 24.45^{2c}} = \sqrt{600 + 600} = \sqrt{\underline{1200}}^{b}$
48 33
96 42
192 51
$\underline{384}$ 60

TAE
J Kruesi

M. N. Force
Wm Carman

X, NjWOE, Lab., Vol. 16:204, 203 (*TAEM* 4:648, 647). Written by Charles Batchelor. Document multiply signed and dated. [a]"Nov 6. 1878" and "Electric Light" written by William Carman. [b]Underlined twice. [c]"4" overwrites "=".

1. These calculations appear to represent an attempt to determine the mathematical relationship between lamps with multiple smaller spiral burners and those with a single spiral. The initial observation that "6 spirals of 3 [thousandths] = 1 spiral of 8 [thousandths]" was probably the result of actual tests and the resulting calculations were an effort to find a mathematical formula to predict the relationship for lamps with other sizes and numbers of spirals.

-1558-

From Grosvenor Lowrey

New York, Nov 7th 1878[a]

My dear Edison:

I got up about 12 oclock and came down to see Griffin, but he had in the mean time gone to my house and so we missed each other.

I judge from the correspondence with Mr Serrell, that you have discovered something new and valuable for the lamp.

I have written today to Col. Gouraud because in his letter to you of Oct 26th he speaks as if he had communicated with me.[1] He has not done so except by two "cables" in relation to Cuba.[2]

The Board met today and four or five of the members want to go out to Menlo Park by the ~~5~~ 4[b] oclock train on Tuesday and wished me to inform you. There is great opposition by

Edson and Banker to letting young Butler[3] go from the Gold & Stock Co., but they said in the meeting today that he had not yet had his vacation but if he wished to take that by going to Washington for you he could do so. No action was taken on the subject but it was left to you to send for him and set him to work for three weeks. You can do this at your laboratory or otherwise, and we will pay him, leaving you to make the terms.

I enclose a proposed letter to be written by you, which will explain itself. It expresses your ideas if I correctly understood them. Very truly

G. P. Lowrey

ENCLOSURE[4c]

Dear Sir:

Referring to our conversations in respect to the disposition on the Continent of Europe of my inventions touching electricity as used for producing light, power or heat, (being the same inventions which I have agreed to sell to the Edison Electric Light Company of New York, for this Country) I have to say that I am desirous to make ~~the same~~ a similar[d] arrangement with you, and, through you, with such Banking or Commercial houses as you may choose, ~~as~~ to that which[e] I have made with respect to the patents for Great Britain;, provided a suitable arrangement can be brought about with Mr Puskas, of Paris, in satisfaction of ~~any, either moral or legal~~ his[f] claims ~~which he may have~~ upon me to be admitted to ~~equal~~[f] participation in the profits derived from the sale or use of these inventions on the continent of Europe

Without entering more in detail into the basis of ~~any~~ this[f] claim ~~which Mr Puskas may make~~, I have now to say that I will give you a power of Attorney for all the European Countries except Great Britain, authorizing you to dispose of all the inventions which I have already made touching these subjects, or may make, during the next five years, for such price and on such terms as you may deem for my best interest, you to reserve one half the price or compensation paid or received at any time whether in royalties, cash payments or otherwise, provided you first obtain a satisfactory release to me from Mr Puskas of any obligation such as I have above mentioned[g] any amount paid or share allowed to him with my approval to be treated as an expense of the joint account.[h]

You are aware that I ~~do not~~ consider Mr Puskas' ~~as having any legal claim. I there~~ claim although not strictly a legal claim as binding ~~upon~~ me morally with as much force as if it were so I therefore[i] do not ask for a release in legal form, but some letter or cable dispatch which will satisfactorily show me that you have met his requirements & relieved me, in honor, from any claim by him. Very truly Yours

LS, NjWOE, DF (*TAEM* 18:63, 177). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted. [b]Interlined above. [c]Enclosure is Df. [d]"a similar" interlined above by Lowrey. [e]"to that which" interlined above by Lowrey. [f]Interlined above by Lowrey. [g]"provided . . . mentioned" canceled and restored; "put back" and "stet" in left margin. [h]"any amount . . . account." interlined by Lowrey. [i]"claim although . . . there" interlined by Lowrey.

1. See Doc. 1551 n. 1.
2. Nothing is known of these cables.
3. According to telegrams he exchanged with Edison, Howard Butler was assistant secretary at Gold and Stock Telegraph Co. He had attempted to see Edison on 30 October regarding his undertaking the proposed study of the state of the art in electric lighting (see Doc. 1535 n. 7), but was unable to do so because of Edison's illness. He apparently came out on 5 November. Butler to TAE, 30 Oct. and 5 Nov. 1878; TAE to Butler, 30 Oct. and 5 Nov. 1878; all DF (*TAEM* 16:346–47, 393).
4 Edison sent this letter to Lowrey (as revised) on 12 November. Lbk. 3:491 (*TAEM* 28:917).

-1559-

From Lemuel Serrell

New York, Nov. 7th 1878.[a]

Dear Sir:

In the interference with DeZuccato[1] I want to arrange for a conference to close up the matter by mutual concessions; In his patent No. 157,161, he makes a porous paper and prints through the same with a pad and a solution of iron. This is based on his English patent No. 1963, of 1872, and this antedates Edison on the broad ground of porous paper and printing by pressure. The parties concerned with DeZ. propose to limit themselves to the chemically prepared porous paper and you to be limited to the mechanically punctured paper and make a business termination on that ground. The patent No. 55,869 to S. Huffman Cartharge, Ill. June 26, 1866 was incidentally referred to. It appears to be for the very instrument that has turned up in the Chicago suit.[2] In a telegram sent to Mr. Bliss today I gave the name and number, and suggested that the patent be purchased. Huffman must be close to Chicago.[3]

If this can be purchased it may antedate some other parties with Dental pluggers, but of that you must examine.[4]

I have telegraphed for an abstract of assignments to see who owns the Huffman patent and will advise, and have written to Mr. Finckel,[5] my agent in Washington to see if the handle was tubular with the needle in it and will advise when answers are received.

You will want to approach Hoffman through a third party or he may get his price up in the sky. Yours truly

Lemuel W. Serrell

ALS, NjWOE, DF (*TAEM* 18:793). Letterhead of Lemuel Serrell. [a]"New York," and "187" preprinted.

1. See Doc. 1358 n. 3.
2. See Doc. 1430 n. 1.
3. Huffman was supposed to be living in Carthage, Ill., but George Bliss finally tracked him down in Independence, Kans. Bliss described Huffman as "an old inventor" who "has been rich but is now broken down in property but he is a very sharp fellow." Bliss bought the patent for $500 and spent another $500 on his trip, which Edison agreed to reimburse. Bliss arranged the purchase so that Huffman would not get all of his money until after he signed the papers for a reissue. This precaution proved useful when others sought to convince Huffman that Bliss had taken advantage of him. The matter was finally settled in early January. Bliss to TAE, 29 Nov., 10, 11, 13, 18, and 30 Dec. 1878, 3 and 6 Jan. 1879; TAE to Bliss, 9 Dec. 1878; all DF (*TAEM* 18:355, 363–64, 366, 373, 377; 50:361, 371); Electric Pen & Duplicating Press bill, 31 Dec. 1878, Cat. 1161, Accts.
4. Edison apparently did so. Notes on dental plugger patents are in NS-Undated-001, Lab. (*TAEM* 8:13–23).
5. Nothing further is known of him.

-1560-

Technical Note: Telephony

Menlo Park, N.J., Nov. 7th 1878[a]

Experiments[b]

Test resistance of the best chalk you have when talking good.[b]

Resistance of same when dried a little.[b]

Have Martin [Force] adjust a transmitter for best talking and get two alike to work with[b]

Put rubber between the ring and diaphragm.[b]

Try a thinner diaphragm of same diameter if not good of wood then of rubber, fibre or of ~~st~~tightly stretched

T A Edison Chas Batchelor
J Kruesi M. N. Force

X (fragment), NjWOE, Lab., Vol. 18:81 (*TAEM* 4:1114). Written by Batchelor; letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted. [b]Followed by centered horizontal line.

-1561-

Technical Note: Telephony

[Menlo Park,] November— 7th 1878

New Receiver—

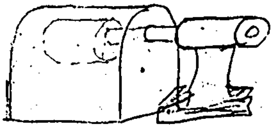
Experiment with differant sizes of buttons—

¾ inch long, and ½ inch in diameter dont seem to give any better results and is more liable to burst. Consequently may be considered a failure.[a]

1 inch diameter— gives about same result as all others— and if anything not so good—[b]

~~⅜~~½ diameter and ¼ long— is very good have left in for constancy—[b]

I put a ~~six~~ 6-30—No 1 in for permanancy with the water supply thus



The button enclosed with a pasteboard box and set in a pan of water— when I put it in it worked satisfactory ~~put~~ but got weaker gradualy, untill~~l~~ It could ~~no~~ hardly be heard, which was probably caused by to great supply of H_2O— took box out and put in ~~Cup o~~ pan with waste in and it has come back ~~be the~~ so it is very loud— will leave it in all night—

in taking diaphram off and putting several thickness of Blotting paper between diaphram and box it decreases the Hollow sound and sounds more like Human Voice—[a]

=Left in for Night=

in Box No 4— a 6-30—No 1— with Paste board in pan works loud—[1a]

in Box No 5= a 6-30—No 1—pressed on the sleeve— work clear but very low—[2a]

in Box— a 6-30—No—with small sponge—in pan Loud but poor articulation—[3]

in Box no 7— a 6-30—No 1— [-][c] ½ inch diameter—and ¼ inch Long, in pan with large sponge— worked ~~loud but poor articulation~~—not very loud and not very good articulation—[b]

try em in morning and compare with the results—

TAE Chas P Edison
Chas Batchelor M N Force
J Kruesi

X, NjWOE, Lab., Vol. 18:80 (*TAEM* 4:1115). Written by Charles Edison; document multiply signed and dated. [a] Followed by centered flourish. [b] Followed by centered horizontal line. [c] Canceled.

1. Charley noted the next day that this "was the loudest but was not as good as last night." Vol. 18:83, Lab. (*TAEM* 4:1117).

2. Charley noted the next day that this "was to dry this morning with sponge in pan." Vol. 18:83, Lab. (*TAEM* 4:1117).

3. This was apparently Box 6, which Charley noted the next day "started loud but then went low." Vol. 18:83, Lab. (*TAEM* 4:1117).

–1562– [Menlo Park,] Novem 8th 1878

Account: Electric Lighting[1]

Statement

Main Building

Aug	30	Labor a/c #1	on Platina Rollers for NR[2]	7.13	
Sept	6	" #1	" "	11.58	
Oct	18	" #1	machinists & carpenters	78.45	
"	"	"	Foreman	21.	
	25	" #1	Machinists	114.12	
	25	"	Foreman "	14.	
	"	Freight	on Timber &c	12.40	
	"	Labor a/c #1	Machinist	1.90	
	31	Patterson Bros	Hadware	51.44	
	"	Meeker & Sons[3]	Castings	7.47	
Nov	1	Manning Freeman[4]	Bricks & Lumber	1054.67	
	8	T. F Carman[5]	Sund & Cartage	138.	
	1	Labor a/c #1	Machinist	37.17	
	"	" "	Foreman	7.	
	"	Patterson Bros	Hardware	1.51	
	"	Sundry Articles	Cash	6.30	
	"	work on well		29.15	
	"	Repairing Pump		2.66	
	2	Labor a/c #1	Machinists	16.	
	"	" "	Foreman	8.	
	1	Thomas[6]	for paints	14.35	
	1	Express ect.		5.08	
	7	Freight	on lime	2.93	
	7	Castings	DeHart[7] bill	6.13	
	8	Pay Roll #2	Masons Laborers	201.49	
					1849.93

Boiler House

Nov	1	Labor a/c #1	Machinists	20.62	
	1	Crowell & Co[8]	Steel rods	4.68	
	2	Patterson Bros	Hardware	10.17	
	4	Fire Brick	Order #2	14.25	
					49.72

			Coal House		
Oct	25	Labor a/c #1	Carpenters	11.25	
	"	" "	Foreman	3.50	
Nov	1	"	Carpenters	17.15	
Oct	29	Bolts & nuts		11.71	
	"	Patterson Bros	Hardware	1.64	
					45.25
			Sundries		
Oct	25	Pay Roll #1	wk induction coil	4.20	
Nov	2	Wallace & Son	wire	13.59	
	1	Platinum wire	Elmore[9] bill	6.53	
	4	Books on Electric light		12.80	
	2	Stamsky[10] Bill	Pain[t] & Oil	7.00	
	6	Elmore bill	platina	15.05	
	1	Pay Roll #1	machinist on induct	8.38	
	7	Platina	Elmore bill	2.23	
					69.78
					2014.68

D, NjWOE, Accts., Electric Light Statement Book (*TAEM* 88:432). Written by Stockton Griffin.

1. This appears to be the first of the weekly statements of electric light experimental expenses that were prepared by Edison's laboratory staff, primarily by Stockton Griffin and William Carman, for the Edison Electric Light Co. Weekly statements continued through early 1882 (see Electric Light Co. Statement Books, Accts. ([*TAEM* 88:412, 512]). This statement covers the first week of November as well as a few items from October and a labor account from the end of August. Most of the entries are concerned with the construction of the new machine shop ("Main Building") and its engine house ("Boiler House" and "Coal House"); other expenses are listed under "Sundries." This statement and the ones that followed were derived from Edison's other accounting records (see "Menlo Park Accounts" and "Personal and Laboratory Accounts, 1878–1891," Accts. (*TAEM* 22:490, 87:5).

Preceding this account are several summaries of expenses prior to this date. One is a 26 October statement of the labor account for the new shop, a copy of which Grosvenor Lowrey's office sent Stockton Griffin on 28 October. This statement lists the wages of masons and laborers, as well as the cost of fire bricks, nails, and advances to Lemuel Serrell. Griffin noted on the back that he had received payment from Lowrey and James Banker for these expenses. Another summary provided by Lowrey's office about the same time shows monies he had received and expended on electric light matters. There is also a "Statement of money expended for Electric Light Experiments prior to Oc 28 1878 by Thomas A Edison" and an entirely undated summary showing the expenditure of over $7,000 provided to Edison by the company. Electric Light Co. Statement Book, Accts. (*TAEM* 88:421–29).

2. "NR" usually meant "new receiver." This entry may refer to rollers created for the telephone but appropriated for electric light work.

3. D. M. Meeker & Son had an iron foundry on Clay St. in Newark. Meeker & Son to TAE, 20 Apr. 1878, DF (*TAEM* 18:445); Ford 1874, 71–72.

4. Manning Freeman was a dealer in lumber, coal, masonry supplies, and fertilizer in nearby Metuchen. Billhead, 28 June 1876, DF (*TAEM* 13:869).

5. Theodore Carman was a local teamster who had also hauled construction materials and machinery for the new Menlo Park laboratory in 1876. Bill to TAE, 20 Mar. 1876, DF (*TAEM* 13:825); U.S. Bureau of the Census 1970, roll 790.

6. D. G. Thomas & Son were suppliers of hardware and domestic furnishings, including carpets and paints. The firm was located in Metuchen. Billhead, 2 June 1876, DF (*TAEM* 13:756).

7. Charles DeHart owned or operated the Newark Edge Tool Manufactory and Grey Iron Foundry, located on Adams St. Bill to TAE, 1 Oct. 1878, DF (*TAEM* 17:430); Ford 1874, 109.

8. Crowell & Coe, located on Mulberry St. in Newark, were dealers in iron and steel and agents for the Newark Steel Works. Bill to TAE, 4 May 1876, DF (*TAEM* 13:845).

9. John Elmore's shop of chemicals and related supplies was located on Murray St. in New York. Wilson 1879, 427; Doc. 487.

10. Dr. William Stainsby was a "Manufacturer of and Dealer in all Kinds of Oils" at 881 Broad St. in Newark, from whom Edison made numerous purchases of gasoline, barrels, and "prime lard oil" in 1878. See bills in Cat. 1161, Accts., NjWOE.

-1563-

Technical Note: Telephony

[Menlo Park,] November 8th 1878

New Receiver—

Experiments with the transmitter set at differant resistance[a]

When transmitter was set at 15 ohms got very nice talking—good articulation but not so loud as we have had it—[b]

with transmitter set at shade higher it is not as good—but gives splendid articulation on box No. 7 containing Button moulded on sleeve—

Experiments with transmitter at differant amount of Resistance— Continued from [-][c] the last page— was louder than the last trial best on box no. 7—[d]

at a shade closer hardly could hear it—[d]

took it a shade back again and it is better but not loud—[d]

with the transmitter at 35½ it is red hot for tube instrument when I put ear to diaphram the talkling and articulation is excellant. it comes best when turned!! just as slow as possibly can turn—think this will be good for clock movement. not loud enough for the presant boxes we are using—[1d]

TAE
Chas P Edison
Chas Batchelor
J Kruesi
M. N Force

X, NjWOE, Lab., Vol. 18:84 (*TAEM* 4:1118). Written by Charles Edison; document multiply signed and dated. Miscellaneous doodles not reproduced. [a] Followed by centered flourish. [b] Followed by centered #. [c] Canceled. [d] Followed by centered horizontal line.

1. Charles Edison continued this entry the next day: "boxes No 4 and 6 with 6.20—No 1—in with Pasteboard in one and small sponge in other have kept constant for three days—having been put in on the 6th inst—and talk very good this morning." He also determined that "the resistance of the transmitter which gives the best talking on 6.30. No 1 which was put in on 6th inst" was 35½ ohms. Vol 18:86, Lab. (*TAEM* 4:1120).

-1564-

Technical Note: Electric Lighting

[Menlo Park,] Nov 10 1878

Electric Light Carbons by Heat & pressure[1a]

Powdered bituminous coal pressed whilst hot gives good conductor[2a]

Powdered bituminous coal & sugar NG[a]

Lamp black and Sugar first heat & pressure seems to have no conductivity[b]

Afterwards heated in crucible it is a good conductor. heated again in Carbon dust Excellent conductor[b]

Powd Bit. coal burnt to coke—conductor saturated with sugar & dried. ~~no better~~ non conductor Powd. & put in mould with heat—good conductor Baked with carbon dust excellent & hard

T A Edison
Chas Batchelor
J Kreusi
M N. Force
G E Carman
Wm Carman

X, NjWOE, Lab., Vol. 16:224 (*TAEM* 4:665). Written by Charles Batchelor; document multiply signed and dated. [a] Followed by centered horizontal line. [b] Paragraph enclosed by brace; followed by centered horizontal line. [c] Document damaged.

1. This document appears to be related to the lamp design shown in Doc. 1567. Drawings of a mold for these carbons are in Vol. 16:249, 258, Lab. (*TAEM* 4:689, 697).

2. On 23 November, Batchelor drew up a list of bituminous coal and sugar mixtures to be tried for electric light carbons. On 13 November

he also indicated that they were going to try anthracite coal. Vol. 16:257, 296, Lab. (*TAEM* 4:697, 735).

-1565-

Technical Note: Electric Lighting

[Menlo Park,] Nov 10 1878[1]

[Potassium][a]

No 1 Sylvine K[b] melts instantly allows arc to be longer—

No 2 Carnallite K.[c] ditto—

No 3 Alunite K. Dont melt so easy shortens arc, non condr—

No 4 Polyhalite K. melts easy non condr lengthens arc slightly

~~Sodium~~[2]No. 5[d] ~~Rock Salt~~ orthoclase (Potassium)[e] fuses to bead that appears permanent= non condr—beads keeps white hot for 30 seconds Shortens[d] Arc[d]—

6[d] ~~Cryralite~~ Rock salt[f]—Melts instantly. Makes arc very much longer & much whiter

7[d] ~~oliglocase~~ cyralite—[g] shortens arc

Potassium

8. Oligoclase melts into nice white glass shortens arc[h]

9 Natralite N.G. shortens arc

Lithium

10 Triphylline[3] good[g] conductor when[d] hot= shortens arc greatly

11 Spodumine— non condr when fused shortens arc—

12 ~~Lepid~~Petrolite,[4] NG [g]non condr—

13 Lepidolite— non condr NG

~~14 Heavy Sp~~

Barium

1~~3~~4 Heavy Spar– non condr

1~~4~~5 Witherite, Conductor when very hot, boils.

16.[d] Barito-Calcite., No. G.[h]

Strontium

17 Coelestine[5h]

49. Prusylite Black ox Mang[6] utterly infusible in arc increase luminosity arc 200[d] per cent works beautifully by incandesce. Biggest strike yet some peices (impure) melt perhaps because silica in it or a metal.[7]

99— N. G. Non Condr—

71 Zincite—after fusing[d] in arc is a good condr. but fuses easily. Its magnetic shewing Iron in[g] it

TAE Chas Batchelor
J Kreusi M N Force
G E Carman Wm Carman

X (fragment?), NjWOE, Lab., Vol. 16:239, 238, 235, 240 (*TAEM* 4:680, 679, 676, 681). Document multiply signed and dated. [a]Document damaged; heading also written on second page. [b]"Sylvine K" interlined above. [c]"Carnallite K" interlined above. [d]Obscured overwritten characters. [e]"orthoclase (Postassium)" interlined above. [f]"Rock salt" interlined above. [g]Interlined above. [h]Followed by horizontal line across page.

1. For earlier Edison designs of incandescent lamps with incandescing materials in a carbon arc, see Docs. 1044, 1078, and 1098.

2. Edison wrote "Sodium" here and began an entry on rock salt, which he then changed to orthoclase, which contains potassium. There is a line after the orthoclase entry indicating the beginning of the sodium minerals (rock salt, cryolite, oligoclase, and natrolite).

3. Triphyline or triphylite, apparently a compound phosphate of iron, manganese, and lithium. *OED*, s.v. "Triphylite."

4. Probably petalite, lithium aluminum silicate.

5. Probably celestite, a naturally occurring form of strontium sulfate.

6. Pyrolusite is a naturally occurring form of manganese dioxide, which is also known as manganese black.

7. On the same day Batchelor wrote about experiments with No. 49: "First piece—melts in 10 minutes into a pasty mass Second piece Impossible to melt Third piece—cannot melt I notice that it wears entirely away under the arc." Vol. 16:244, Lab. (*TAEM* 4:684).

-1566-

From Grosvenor Lowrey

New York, Nov 11th 1878[a]

My Dear Edison:

Enclosed you will find a letter which is sent to me by Mr A. Belmont.[1]

Mr Belmont is exceeding anxious to procure an interest in the Electric light Co. of this city and I have told him I will see what can be done. In the mean time instead of sending forward to Mr. Puskas the Vienna[b] letter which you sent me, I will hold it for a day or two until you give me further instructions in view of the possibilities which are disclosed by this letter of the Rothschilds.[2]

From all that I can ~~I can~~ learn of Mr. Puskas he would probably be a very useful and effective man[c] working in connection with serious and successful people such as our friends Drexel Morgan & Co & Belmont are; while he probably would not meet with so much success if he were to operate alone

As I have before said to you, Mr Puskas will probably consider i~~n~~t[d] to his advantage to have a minor[c] share of the larger[b] profits which these great houses will make rather than a larger share in what he will be able to make without them.[e] It will not be altogether sufficient—that[c] you should make the best electric light. Two things must coincide: you must vanquish all the difficulties in nature and your financial agents must have the standing to enable them with[c] a strong hand[c] to put aside all competors[c] in the financial field; or if they are not able altogether to put them aside, to put them in the back ground. It is the same case over again of the Western Union as[c] a partner and friend, ~~an~~or some other equally deserving but much less powerful associat~~ione~~[f]

I enclose a letter by the way such substantially[b] as I think you ought to address to Brewer & Jensen for Mr Shea.[3] I will[c] also write a letter which I will recommend you to send to Mr Puskas to be a part of the means for bringing himself and Mr Harjes into proper relations.

I see that ~~Sweden &~~ Norway ~~are~~ is[b] not[c] included in the telephone patent of Mr Puskas, and there are several letters[c] here from people in those countries. Will you give me a power of attorney for you in those countries? If so I will either put those at once into the same course as the English patents or will communicate with other parties.

Messrs Fabbri & Chauncey,[g] who are now managing the South American countries, & have telegraphed out to their various correspondents to get special concessions and priveliges in those countries, would like to undertake India, China & Japan, and perhaps Australia and other English colonies provided these are not claimed by Drexel-Morgan & Co.

I should like to be able to give before next Saturdays mail to Mr Belmont a clear & concise statement, in general terms of course, of what you have done and what you already see in view; nothing which will amount in any way to a description but the substantial particulars which Baron Rothschild asks for. I took young Belmont to task for that phrase in the letter which says, "The Microphone, Phonograph &c were trifles", and asked him if he supposed Rothschild had ever heard of the carbon telephone and whether he considered that a trifle.

Can you find time or if you cannot can either Batchelor or Griffin make such a statement for me.[4]

It should be a statement entirely free from enthusiasm and should answer the following questions;

1st Has Mr Edison devised[c] a means by which he can make use of the electric current to produce in the same circuit any considerable number of lights ⟨yes several thousand⟩

2nd Is he able to regulate and control the light so as to make it equally feasable, agreeable & convenient for domestic use as the ordinary gas light. ⟨It equals one gas jet and may be regulated to any lesser amount it is perfectly steady⟩

3d How would, in Mr Edisons opinion, the original outlay to light a town of a given number of inhabitants, say of 100,000. by his method compare with the original outlay to light the same by gas. ⟨Cannot give figures but it will be twice or [-][h] thrice;⟩

4th How would the expense of maintainance &c of his system compare with the expense of the lighting by gas. ⟨Cannot give figures but it will be at least twice as cheap & I hope four times as cheap⟩

5 Is Mr Edison obliged to avail of any other patents than his own for any purpose ⟨No⟩

6th. Does Mr Edison believe that the existing plant of gas companies such as underground pipes, gas fixtures &c can be utilized with any profit in serving the electric light ⟨All the gas fixtures in the houses can be utilized x⟩

Some of these questions of course, the 1st, 2nd, & 6th[i] I could answer myself from what you have told me but I should like to have the thing in a form in which it can be[c] forwarded to the Rothschilds with your signature. I think it would be interesting to them to have it. Still do not bother about it at all at the expense of other things Very truly yours

G. P. Lowrey

I[j] enclose the agreement with the Edison Elc. Company for signature, it being now right—[5] There will be also a special letter by you to the secretary directing him to deposit[k] $100,000 in shares with E. P. Fabbri to divided among the subscribers in accordance with the original arrangement— This I will draw before the agreements are exchanged.

Letter (form of) to Brewer & Jensen[k] (enclosed[6]

LS, NjWOE, DF (*TAEM* 18:181). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted. [b]Interlined above by Lowrey. [c]Corrected by Lowrey, obscured overwritten letters. [d]Corrected by Lowrey; originally "into." [e]"without them" interlined above by Lowrey. [f]Corrected by Lowrey. [g]"& Chauncey" interlined above. [h]Canceled. [i]"of course . . . 6th" interlined above by Lowrey. [j]Paragraph written by Lowrey. [k]Obscured overwritten letters.

[1] This letter from August Belmont has not been found. In 1874, Belmont had entered the banking house founded by his father, August Belmont & Co. The senior Belmont established the firm in 1837 after emigrating from his native Germany, and it became the United States representative of the Rothschild family and an important financial power in its own right. *NCAB* 37:25–26; 11:499.

[2] Belmont apparently sent a 25 October letter from Salomon Albert Rothschild, head of the family firm in Vienna. A typed transcript of this

letter (incorrectly identifying it as from S. M. Rothschild) was subsequently sent to Edison on 21 November with a note that it was "the first letter, which was mislaid." Rothschild had written Belmont that he had seen English press reports of Edison's light and that "It would greatly interest me to learn, whether really there is something serious and practical in the new ideas of Mr. Edison, whose last inventions, the microphone, phonograph, etc, however interesting, have finally proved to be only trifles." He asked Belmont to send information and his opinion about the feasibility of replacing gas lamps with Edison's light. Porter, Lowrey, Soren & Stone to TAE, 21 Nov. 1878; Rothschild to Belmont, 25 Oct. 1878; both DF (*TAEM* 18:201–2); Wilson 1988, 253–54, 272–77.

3. In a letter to Brewer and Jensen, which they forwarded to Lemuel Serrell, Charles Shea claimed to have anticipated Edison in dividing the electric current. On 26 October 1878 he had received a British patent on a device for "Dividing and Distributing the Current Produced by Galvanic Batteries, &c" in which rotating contacts rapidly made and broke a series of circuits (Dredge 1882–85, 2:lv). Edison apparently had Stockton Griffin write out a letter to Brewer and Jensen based on Lowrey's enclosure (which has not been found). Griffin's copy is dated 13 November and a docket indicates that it was not sent. In this letter, Edison stated that as "to the present doubtful question whether he and I may have hit upon the same devices so that letters patent to one might be made totally destructive of the interests of the other, I am indisposed to entertain any proposition whatever. If he, or any person has made a prior invention I shall congratulate him." If not, however, "I shall be unwilling to run the risk of having to share the credit with another person. Upon this point I have always been strenuous" (DF [*TAEM* 18:807]).

4. When he had not heard from Edison, Lowrey wrote to Griffin on 16 November regarding the information for Belmont, "about which I feel special desire to be full and accurate." He asked Griffin to "let me have what you can as soon as possible, and mention this to Edison as a matter in which I feel desire to comply." Two days later, Lowrey asked Edison to indicate if he could "come up the latter part of the week" so that Lowrey could arrange an interview with Belmont. DF (*TAEM* 18:199–200).

5. Doc. 1576. The next day, Lowrey wired Edison to return the agreement unsigned because not all the blanks had been filled. DF (*TAEM* 18:67).

6. See note 3.

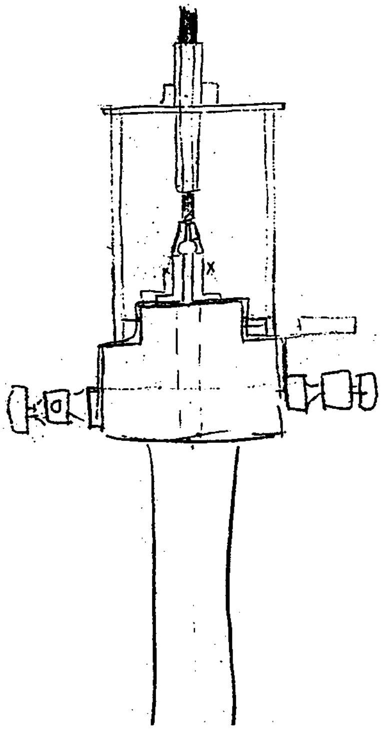
-1567-

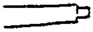
Equipment Specification: Electric Lighting

[Menlo Park,] Nov 11th 1878

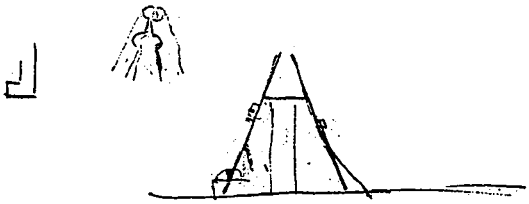
Mr Kruesi

Make an instrument like this.[1]



XX are two pieces platina made in shape of a hollow cone. the carbon has a little tit on it so  which lays in the hole in platina and the rod is pressed down on platina; as carbon burns away the cores drop through.

Make more bevil to the platina than is shown in sketch



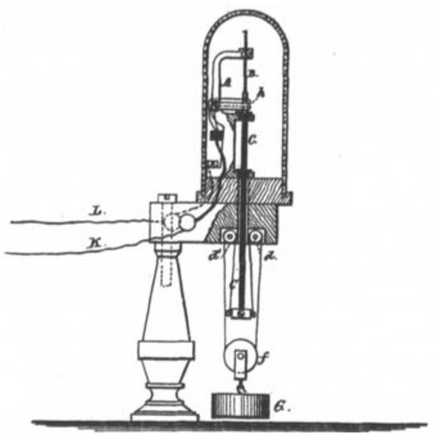
TAE
J Kruesi

Chas Batchelor
M. N. Force
Wm Carman

X, NjWOE, Lab., Vol. 16:247 (*TAEM* 4:687). Written by Batchelor.

1. Edison executed a patent application for a related design on 25 January 1879, which issued as U.S. Patent 224,329 on 10 February 1880. In that patent Edison noted that

> The inferiority of contact which takes place between the metal and the carbon creates a considerable resistance, which, heating the car-



Edison's patented design for a carbon and platina incandescent lamp.

> bon, increases the inferiority of the contact, causing the carbon to become highly incandescent; but no effect is produced upon the platinum or iridium alloy.

In the patent he showed three methods of regulating the pressure of the carbon against the platinum—the carbon pressing downward by its own weight, the carbon being pressed downward by a weight resting on top, and the use of a weight and pulley arrangement to press the carbon upward against the platinum. Some January 1879 drawings related to these designs were later misdated as January 1878 (Vol. 16:1–4, Lab. [*TAEM* 4:479–82]); see also Doc. 1627 n. 2.

-1568-

To Howard Butler

Menlo Park, N.J., Nov 12 1878[a]

H R Butler

Please ~~send~~ say to[b] Mr Upton[1] I would like to see him

Edison

LS (telegram), NjWOE, DF (*TAEM* 18:67). Letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted. [b]"say to" interlined above.

1. Butler replied the next day: "Mr Upton will be at your laboratory this P.M." (DF [*TAEM* 18:69]). This was the beginning of Edison's association with Francis Upton, who played a major role in electric light research. A native of Peabody, Mass., where his family knew Grosvenor Lowrey, Upton attended private schools in Boston and received a bachelor's degree in mathematics from Bowdoin in 1875. Two years later he took the first master's of science degree conferred by Princeton. He then studied with Hermann von Helmholtz in Berlin for a year. Although he had planned for an academic career, on his return to the United States he decided to go into business. After Butler introduced him to a vice president of the Gold & Stock Telegraph Co., Upton wrote his mother that he hoped to be offered a clerical job and eventually to "have a chance to take charge of a telephonic system in some

city" (Hutchings 1978, 8–11; Jehl 1937–41, 512; Upton to Lucy Upton, 7 Nov. 1878, Upton [*TAEM* 95:497]).

-1569-

From Vesey Butler

Havana, 11/12 [1878]

My engañadorando[1] Professor

I request that in future you will not address me as your "dear Butler" for I am not your "dear Butler" if I had been, you would have fulfilled your long ago given promise, not promise, but a multitude of them, you are an arrant-professor and if I am a~~n~~ lost angel in the region of Miasmatic &c you can remove the M'Atic and Kiss the rest. aint that good?[2]

And then to add insult to injury, instead of sending me a pair of telephones a present saying "My dear Butler[a] in consideration of having neglected you so long and broken the thousand & one promises ~~you~~ I have made you from time to time, also for the interest[a] you have taken, and energy you have displayed in introducing & selling my early invention the Electric Pen, by which you increased my revenue & enabled me to live ~~l~~as I do like a prince, marry the handsomest woman in Jersey & buy handsome paintings on Broadway (especially in the evening) I now send you a pair of telephones with a small silver presentation plate (To my esteem friend &c) guaranteed to stand lightning or "James,"[3] also my micro Hughesatic Phonograph (this is added as you[b] I may thank you for stimulating me to my experiments in the electric light" (you may remember this & how I worried Bliss to drive you into this matter), but instead of this you refer me to Mr Bergman & quote me $50—for one station[4] Oh Edison! "Oh justice thou hast fled to—&c "Shakespear"—

I never expected this from such a rich, talented, and I may say handsome man— However in consideration of the precepts of the Bible (which has had a good time of it before the telephonic period) I shall forgive & turn to you my other cheek[a] that you "may smite."

Leaving all jokes aside I must congratulate you on the happy results of your experiments & your great success in all that you have undertaken I keep myself very well read up in all your advances as I receive nearly all the scientific papers of England & the States.

I hope Batchelor is well give him my regards you may tell him I consider him in the unholy compact with you to "sell me"—

Have you heard from McLoughlin? how is he doing? he is a very live boy & ought to make his mark as a showman

I should be glad to know Mr Wheelers[5] address if you can favor me with it—

I intended to have had the pleasure of seeing you this month but have been detained by my poor wifes illness, which is I fear fatal, the doctors having retired & the clergymen attending

Trusting that you & your family are well I remain Yours truly

V F Butler

I am sending Wallace his lights back at his request in exchange for his new machines—

ALS, NjWOE, DF (*TAEM* 16:421). [a]Obscured overwritten letters. [b]Underlined twice.

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1. "Engañadorando" would mean roughly "sweet deceiver" (or "dear liar").

2. Edison had replied to an earlier Butler letter on 4 November, "I am glad to hear the cry of lost angel way down in the region of miasmatic malaria." Butler's letter was the most recent in a series complaining that Edison neither wrote him nor kept his promise of sending a phonograph and a telephone set. Butler to TAE, 2 Oct. 1878; TAE to Butler, 4 Nov. 1878; both DF (*TAEM* 16:177, 382).

3. Slang term for a crowbar. Farmer and Henley 1970, s.v. "James."

4. In his letter of 4 November (see note 2), Edison told Butler that he could buy telephones from Sigmund Bergmann's shop for $50. Edison described the Bergmann instruments as guaranteed "to stand lightning & be 20 times louder than Bell."

5. William Wheeler.

-1570-

To Theodore Puskas

Menlo Park NJ Nov 13. 78[1]

My Dear Puskas

I telegraphed you on the 22d of Sept as follows concerning the Electric Light.[2]

"Puskas Paris: Good— Send papers. Cannot come have struck a bonanza on Electric light indefinite sub-division of light. Shall Serrell take patents for Continent same as before? Send authorization. Edison"

Your reply being received, I wrote you in confirmation and explanation of the above Oct 14th. When I discovered the process by which I now divide the light together with the other things which are included in my patent, I soon found that I had opened a field of investigation which would not only take a great deal of time but also a large sum of money—much larger than I could conveniently manage for myself and accordingly I was obliged to call upon friends here for aid. Without entering into particulars for which I have not the time now I had the good fortune to find $50.000 ready to be invested in confidence of my ability to bring it back again and I am now erecting a brick building 135 feet long by 25 feet wide with two powerful Engines (80 H.P.) and boilers, in short all the means to set up and test most deliberately every point of the Electric Light so as to be able to meet and answer, or obviate every objection before showing the light to the public or offering it for sale either in this country or in Europe.

You can well understand that the question of my European patents arose immediately and filled a large place in our negotiations. I have explained to them my relation to you and they have examined the Telephone and phonograph agreements, and the cables which have passed between us, together with the fact of your payment of the patent fees. They will within a few days communicate with you through their Paris house with a view of uniting with[a] you to act as agent for the sale of the light in all the countries, except Italy as to which country Messrs Fabri & Chauncey of New York are thought to be better agents, Mr Fabri being an Italian of the best connections and standing in that country. Mr Fabri of Drexel Morgan & Co is a brother of Mr Fabri of the other firm[3] and probably they will confer with you through the same agent in Paris, notwithstanding the intention in case you make terms with them to work Italy through Messrs Fabri & Chauncey in connection with you. Now I feel great delicacy in speaking to you about this matter, but I feel so convinced that the ultimate outcome of the Electric Light will be vastly greater if managed everywhere by such financial houses as J. S. Morgan & Co of London and their houses and connections in other Countries that I believe you will realise more money by acting with them even at a greatly reduced share—if that should be necessary to secure their co-operation than any man, even you, could realise working alone.

It is my intention never to show or offer the Electric light until it is so perfected in economical and all other respects that I can feel sure of its instantaneous victory over gas. This I can accomplish only through the continuing aid of Drexel Morgan & Co and their friends. The light is not yet in any shape to show and you can see therefore that they are practically engaged in investing their money in large amounts to bring my inventions to perfection.

I hope therefore that you and they will be able to arrive at an equitable arrangement for dividing the portion of the proceeds of sales which I am willing to allow so that I may have the satisfaction of knowing that your skill and capacity are united with their commercial facilities to get the last dollar for Electric light which the Continent of Europe has to offer.[4]

I have telegraphed over additional inventions since the application for a patent went over and I am now on the track of a lot of important additions for which several sets of patents must be taken out in order to protect the invention completely. Before I have done with it I mean to succeed. I have the right principle and am on the right track, but time, hard work and some good luck are necessary too— It has been just so in all of my inventions. The first step is an intuition and comes with a burst— Then difficulties arise. This thing gives out then that. "Bugs" as such little faults and difficulties are called, show themselves— Months of intense watching, study and labor are required before commercial success—or failure—is certainly reached. Yours very Truly

Thomas. A Edison G[riffin]

LS (letterpress copy), NjWOE, Lbk. 3:487 (*TAEM* 28:913). Written by Stockton Griffin. [a]Interlined above.

1. A draft of this letter, written by Grosvenor Lowrey and dated 13 November, is in DF (*TAEM* 18:193); the original is in HuBPO.
2. See Doc. 1451.
3. Probably Ernesto Fabbri of Fabbri & Chauncey. Wilson 1878, 418.
4. Having received no response, Edison cabled Puskas on 27 November, "Let me hear promptly in answer to letter of 13th." Puskas wired back two days later, "Will reply as soon paris [house] communicates. Is that right." DF (*TAEM* 18:203).

-1571-

From Grosvenor Lowrey

New York, Nov 13th 1878[a]

My dear Edison:

I learn that it is a practical necessity of prime importance in Cuba to get local concessions by the towns. This can be much better done from here by persons having Cuban connections; and it should be done promptly. Nothing seems to stand in the way except that an examination of the Spanish law shows that there is no longer a particular law for Cuba[1] and thus that Mr. Puskas is in the way. Being so far off perhaps he would yield up to you any claim on Cuba.

I can make an arrangement with Mr. Navarro[2] to pay all expenses for one half (½) and to pay also five (5) percent. of that half to Mr Puskas. This would be better arranged however if it came nominally from you to him although Mr Navarro will arrange it so that you shall have a clear fifty (50) percent of the net result. Will you therefore send at my expense the following telegram to Puskas?

"Parties here have special facilities[b] to obtain local concessions for Electric Light in Cuba. Will you waive claim to ~~any~~ rights in that Island. I will try to have them[c] reserve you small percentage of interest in Cuban ~~rights~~ "profits"[3] Very truly yours

G. P. Lowrey

LS, NjWOE, DF (*TAEM* 18:191). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted. [b]Interlined above. [c]"have them" interlined above.

1. According to a report in the 24 August *Scientific American* (39:112), recent changes in Spanish law provided that a single patent "now covers not only Spain, but all the Spanish colonies—the Balearic Islands, the Canaries, Cuba, Porto Rico, the Philippines, and Fernando Po." The new patent law also extended protection to twenty years, lowered fees, and placed "foreigners on the same footing as natives."

2. Financier José De Navarro was a personal friend of Grosvenor Lowrey and an original stockholder of the Edison Electric Light Co. After emigrating from his native Spain, De Navarro lived in Cuba from 1841 to 1855, when he moved to New York. There he organized a banking firm, Mora, De Navarro & Co., and helped establish other concerns, including the Equitable Life Assurance Co. Taylor 1978, 41; *NCAB*, 2:281.

3. Edison replied that he did "not think it necessary to telegraph Puskas. Any arrangement made by me will, I am sure, be satisfactory to him. I think if Mr Navarro will arrange to let him have 5% and add that to 2% from our interest will make it all right." TAE to Lowrey, 18 Nov. 1878, Lbk. 4:1 (*TAEM* 80:18).

-1572-

Technical Note: Electric Lighting

[Menlo Park,] Nov 13 78

Resis of Magneto Generators[1]

~~Weston~~	Weston	Little Wallace	Large Wallace
Resistance including condr wires machine still[a]	8/10 ohms	6 ohms	16 ohms
ditto machine running ~~very~~ slow[b]	8/10 ohms	~~8 ohms current~~	[~~20~~?][c] ~~ohms current~~

No alteration when machines reversed[d]
Resistance of Conducting wires
Bare Copper 2/10 ohms
Kerite in[sulated] 5/10 ohms[e]

T A Edison
Chas Batchelor
J Kruesi

J K Knight[2]
M. N. Force
G E Carman
Wm Carman

X, NjWOE, Lab., Vol. 16:436 (*TAEM* 4:872). Written by John Knight; table entries separated by lines. [a]"Resistance . . . still" enclosed by right brace. [b]"ditto . . . slow" enclosed by right brace. [c]Canceled. [d]Enclosed by double horizontal lines. [e]Followed by horizontal line.

1. It is unclear how these measurements were made, or for what specific purpose. It is possible they were prompted by Edwin Houston's and Elihu Thomson's Franklin Institute report. Edison had probably seen their report, published in the May and June 1878 issues of the Institute's *Journal,* and about this time George Prescott also sent him a draft chapter on electric lighting (see Doc. 1492 n. 1), which quoted extensively from the Houston-Thomson report. During tests of a number of generators, including two Wallace-Farmer machines of different sizes, Houston and Thomson measured the resistance of each generator's internal circuit by taking the mean of several measurements made with the armature in different positions. One of the tables from this report included a column comparing the combined resistances of the machines plus their conductors under different operating conditions. Here John Knight appears to be comparing the resistances of the three generators that Edison had in his laboratory at this time along with their conductors when the machines were not running and when they were running slowly. It is unclear whether bare copper or kerite-covered conductors were being used. Houston and Thomson 1878; Prescott 1879, 456–57, 466.

2. John Knight applied to Edison for employment in August 1878 after he lost his job with the Gold & Stock Telegraph Co. He began work at Menlo Park on 4 September, but left a month later for an absence of five weeks. When he returned in early November, he tested generators, studied the radiating properties of various materials for the electric light, and made carbon buttons. Knight was discharged in January 1879 for an unexcused absence related to marital difficulties; he was subsequently employed by the Edison Electric Light Co. Timesheets; Knight to TAE, [28 Aug. 1878?], 25 Feb. 1879; TAE to W. H. Baker, 24 Jan. 1879; Mrs. John Knight to Stockton Griffin and Griffin to Mrs. Knight, both 25 Jan. 1879; Knight to Samuel Insull, 10 Oct. 1881; all DF (*TAEM* 17:698, 706, 714, 722, 777, 787, 798, 804–5, 822, 833, 845, 857, 870–71, 504; 49:881, 870; 57:705); G&S Executive, 199.

-1573-

Technical Note: Telephony[1]

[Menlo Park,] Nov 13th 1878

New Receiver

Experiments with differant diaphrams with a 6.30. No. 1—button—[a]

Hard rubber diaphram does not change the talking very much—although think it helps the articulation a little—[a]

Vulcanized Fibre—dont see much differance between it and wood—[a]

Carbon plate—about quarter inch thick is bang up—good articulation—[a]

thick mica—is very loud louder than Carbon and wood better articulation than wood and louder than wood—but not as good articulation ~~than~~ as Carbon but for general purposes mo desirable—[a]

Wood ¼ thick.— not good results to low and not striking articulation—gives hollow sound—[a]

Buttons.[b]

Chalk Button of 6.30. No 1—with small amount of glycerine no great chang[a]

Button with glycerine instead of water is very low hardly hear it—plays out—did not put any water in box—large amount of glycerine was used[a]

Button with small quantity of glycerine was louder than above but was not satisfactory[a]

took[c] a button that stood on table several days and put in box with mica diaphram—and it started off good but seemed to have only a little ~~moisture~~ dampness on out side and soon played out—have left in to see if it will come up again—[a]

have taken water out of the other two boxes to see if is not too much dampness instead of not enough[a]

when water is taken out of the two boxes they get worse—and got quite low I put little water on the button and put ~~pan~~ pan in box again when it went very good—

Diaphrams[a]

Zinc Diaphram about⅛ thick—is no good very low—[a]

Thin Mica Diaphram work very good not much differanc between that and thicker— G[ood].n[ight][a]

Chas P Edison

X, NjWOE, Lab., Vol. 18:88 (*TAEM* 4:1122). Written by Charles Edison; document multiply signed and dated. [a]Followed by centered horizontal line. [b]Centered between wavy lines; followed by centered horizontal line. [c]Large "X" in left margin of this paragraph.

1. This note is continued in Doc. 1575.

-1574-

From Edward Johnson

New York Nov 14/78

My Dear Edison

Item. 1 I have seen U. H. [Painter] and have got him to consent to aid in the matter you spoke to me about when last at menlo. All you want is to see him personally and make your bargain. He goes to Washn. in a few days and can make his usefulness to you immediately apparent

Item 2. Having called a meeting of the Stockholders on only the notice required by Directors Meeting, I had to revoke the call & make a new one with longer notice thus deferring the meeting until Nov 23.[1] This gives me a few days longer to make the final payments on my stock.

Item 3. Everything having petered out in Electric Light matters I have determined to absolutely control the Phonograph—tie myself up to it for a "future"—

If I sell the Block of Stock to Gold & Stock or other comparative strangers I may simply be jumping out of the Frying Pan into the fire. I therefore resolved to take in Reiff and unitedly with his[a] Painter's and your assistance purchase the thing ourselves—thus effecting my end beyond peradventure.

Item 4. $2000 cash are required. My resources are as follows.

Reiff has paid $500.
Leaving to raise yet= $1500.
Reiff will raise $500. possibly $1500.
Painter " " 500.
Edison is asked to loan[b] 500. to me= $1500

Item 5. I find the Phonögraph Co. owe you a/c Royalties on Exhibitions about $1300.

Item 6. I want you to make a demand upon us for a ~~partial~~ payment on this a/c. upon whatsoever pretext you please. (It is generally supposed that your Electric Light funds are only available for[a] purposes strictly Elec. Light—this is your best cue)

Item 7. I want to borrow this money until I get control.

Item 8. Reiff, Painter and myself will unitedly agree to be responsible for its early repayment.

We will also agree to immediately allow the Royalty on Exhibition a/c and pay you the balance.

Also, pay you the $400 due by C.A.C[heever].

Item 9. Possibly—owing to the sympathy of the present Treasurer with the present control—we may not be able to effect a payment to you on a/c— in that case are you in position to obtain elsewhere the $500. for the brief interval between now and the meeting of the 23rd If not and I am blocked everywhere else will you ask some of your friends at P L S & Stones[2] to make me the loan—

I map out these points to prevent the possibility of failure— I may not have to resort to a single one of them.

This is your opportunity to "Place" me permanently in a position where I will be abundantly able to take care of myself henceforth at absolutely no risk to yourself

Make me solid in this and the Phonograph Co will prove a handy bank wherein you may at all times get accommodation for emergencies[3] Very Truly Yours

E. H. Johnson

ALS, NjWOE, DF (*TAEM* 19:152). [a]Obscured overwritten letter. [b]Interlined.

[1] The meeting had been scheduled for 15 November. Johnson to TAE, 13 Nov. 1878, DF (*TAEM* 19:150).

[2] The law firm of Porter, Lowrey, Soren, & Stone.

[3] The preceding day Johnson had asked Edison to loan him money to take over the company, promising that "If you get the thing in my hands you will have a good bank to get your paper discounted in emergencies." Johnson to TAE, DF (*TAEM* 19:151).

-1575-

Technical Note: Telephony[1]

[Menlo Park,] November 134th 1878

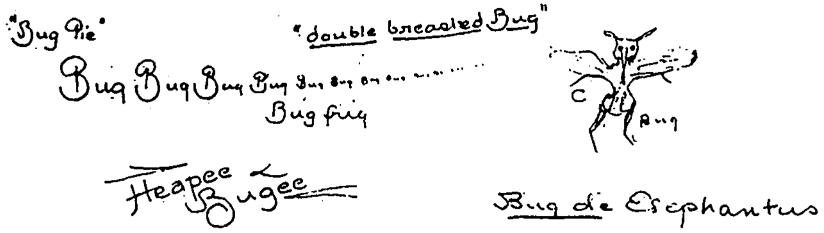
New Receiver[a]

Have box no 6 and shallaced both in and outside to see if it will keep button from getting dry—[b]

It seem ~~if~~ as if the button wants to be dry on the inside and slightly[b]

have put in an old button in box no 6 it gave very fair talking when put in and sealed up— Will leave in to see if it will keep damp—[b]

dont work good this morning— Bug. Heap Bug[b]



it is shown in using Mica diaphram that we do not want resonance such as given with a wooden diaphram—and would suggest an Iron box be substituted for the wooden ones now in use as it would do away with hollow sound which is so detremental to fine articulation, without increasing the Volume.[c]

~~tr~~ put on the other transmitter and every thing went Bang up—the trouble was not in the buttons getting dry—but in transmitter[b]

Chas P. Edison

X, NjWOE, Lab., Vol. 18:90 (*TAEM* 4:1124). Written by Charles Edison; document multiply signed and dated. [a]Underlined twice. [b]Followed by centered horizontal line. [c]Followed by centered flourish.

1. This note is a continuation of Doc. 1573 and is continued in Doc. 1578.

-1576-

Agreement with Edison Electric Light Co.

New York, November 15, 1878[a]

This Agreement made the fifteenth day of November in the year one thousand eight hundred and seventy eight, between Thomas A Edison, of Menlo Park, New Jersey, party of the first part, and The Edison Electric Light Company, a corporation created and existing under the laws of the State of New York, and hereinafter called "the Company," party of the second part.[b]

Witnesseth:[b]

Whereas the Company has been organized with the view of becoming the owner of and of making, using and vending and licensing others to make, use and vend within the United States and other countries or colonies hereinafter mentioned all the inventions, discoveries, improvements and devices of said Edison, made or to be made, in or pertaining to Electric Lighting, or relating in any way to the use of electricity for the purposes of power, or of illumination or heating; or relating to improvements in Electric Engines or to the developing of electric currents by machines or otherwise, for any use or purpose, except electric telegraphy.[b]

And Whereas the said Edison is willing and desirous, in order to obtain the means to continue his investigations in the subjects above named, to transfer, upon the terms heretofore agreed upon and hereinafter fully set forth, all the right, title and interest in his said inventions, made or to be made, as herein provided, and the exclusive use thereof in the countries above named, together with all letters patent of the United States or Canada, and all letters patent, special grants, concessions or privileges of any other State or country of North or South America, excepting the possessions of Spain, which may be granted for any of said inventions, discoveries, devices or improvements.[b]

Now therefore, in accordance with said terms and in consideration of the mutual agreements of the parties hereto, as herein set forth, they respectively agree with each other as follows:[c]

First. The said Edison hereby sells and assigns to the Company the entire right, title and interest in and to all inventions, discoveries, devices and improvements which he has hitherto made pertaining to Electric Lighting or to the use of electricity for the purposes of power, or of illumination or heating, or to improvements in Electric Engines, or to the developing of electric currents by machines, or otherwise for the uses or purposes above mentioned or any of them; and especially all inventions, discoveries, devices and improvements which are described in the following applications and caveats for patents of the United States, namely; an application in Case numbered 156, dated October fifth, 1878, filed October 14th 1878; applications in Cases number 162 and number 163, prepared by L. W. Serrell & Son but not yet signed; in caveats numbered 82, dated October 7th, 1878, 83, dated October 25th, 1878, 84, dated October 12th 1878, and 85, dated October 25th, 1878; and also those which are described in a certain application and the papers thereto pertaining for letters patent of the Dominion of Canada, dated October 25th 1878: and does also agree that all other inventions, discoveries, devices and improvements of the character above described, and all improvements which he may make within the period of seventeen years from the date of this instrument shall be deemed to have been made for and shall belong to the Company; and that he will take all such steps as are provided in the third article hereof to secure to the Company letters patent of the United States and Canada, and such letters patent or other special grants or concessions of any other State or country of North or South America, except the possessions of Spain, as can be secured from them or any of them. It being specially understood and provided, however, that this agreement is not intended to convey or give any interest to the Company in any invention designed or capable solely of being used in electric~~al~~ telegraphy; or to give any right of use for electric telegraphy of any invention which may be applicable to that as well as to any of the other purposes which are the subject, as above named, of this agreement; but the right of use of any invention, discovery, apparatus or device contemplated by this agreement for electric telegraphy remains in said Edison, and the Company agrees to grant, under any letters patent belonging to it, such licenses for his benefit as he may request for the business of electric telegraphy.[c]

Second All inventions or discoveries of the character described in the first article hereof which may be made by said Edison within the first five years of the period above named, and all improvements which he may make during the same period upon any of such inventions, devices or improvements shall belong to the Company without further consideration; but compensation shall be due for all inventions or improvements made after the expiration of said five years; and immediately upon the issue of any letters patent, grants, concessions or privileges for inventions, discoveries, devices or improvements made after the expiration of said five years, if the Company desires to hold such inventions and patents, such compensation shall be due and payable; and if the parties are unable to agree within three months from the date of such letters patent, grant or concession, upon the amount and the time, conditions and manner of payment of such compensation, the same shall, upon the written demand of either party, be submitted to arbitration of two indifferent and disinterested persons, one to be chosen by each party, with power to choose a third, and the decision of such arbitrators, or of a majority of them, shall be final and binding upon both parties.[c]

Third The said Edison agrees, that in respect to all the inventions and improvements herein provided for, he will promptly file, in the proper offices of the United States and Canada, such caveats as may be necessary, in the judgment of the Company, to protect the same; and will also promptly thereafter file his applications in the same offices for letters patent therefor, with requests that such letters patent may be issued to the Company as sole owners thereof, whenever the laws allow; and will, simultaneously with the filing of such caveats or applications, also deliver to the Company special assignments to it of all the right, title and interest in and to such inventions and improvements.[b]

And said Edison also agrees to prepare or cause to be prepared such drawings, models and specifications of the inventions and improvements provided for by this agreement, as may be necessary, in the judgment of the Company, or as may be required by it, to describe and illustrate them fully, and to deliver the same, with all sketches or memoranda pertaining to them, to the Company, and at all times, upon the request of the Company, to make, execute and deliver to it all amended specifications, models, drawings or applications that it may reasonably require, and all new or other assignments that may be necessary to secure to the Company the exclusive ownership of all the inventions, discoveries, devices and improvements intended by this agreement, in their most perfected form, together with all papers required to secure re-issues, renewals or extensions of letters patent, grants or concessions for any of them.

And said Edison agrees, from time to time, as requested by the Company, to take all such other measures as may be necessary to procure letters patent or other grants or concessions, protecting his inventions, in such other States or countries of North or South America, except the possessions of Spain, and to assign to the Company, immediately upon receipt of them, all such letters patent, grants, concessions or privileges which may be issued in the first instance directly to him; but the expense of all things done in accordance with the provisions of this agreement, except as otherwise specially provided on the Fifth Article hereof, are to be borne by the Company.[c]

Fourth The said Edison agrees, on behalf of and for the benefit of the Company, to prosecute with his utmost skill and diligence, further necessary investigations and experiments upon the use of electricity for the purposes described in the first article; and to endeavor to discover and devise the best and most economical means, modes and apparatus for applying electricity to the purposes above named, and for rendering the means, modes or apparatus which he may have discovered or devised, more useful, economical and convenient; and to perfect and complete all his inventions and improvements described in the first and second articles, and all such as may result from the further investigations and experiments herein provided for, as far and as fast as may be in his power.[c]

Fifth The Company hereby agrees to issue to said Edison two hundred and fifty thousand dollars of its Capital Stock of three hundred thousand dollars, and to pay him, upon the execution of this agreement, the sum of thirty thousand dollars in cash, of which sum said Edison agrees to expend twenty five thousand dollars, or so much thereof as may be necessary, in procuring and paying for the means and material required for the most effective prosecution of the investigations and experiments provided for in the fourth article hereof, and in defraying all other charges attendant upon such investigations and experiments, as well as the legal or other expenses attendant upon the organization of the Company and the preparation and taking out of patents in the United States and Canada for his inventions already made and described in the caveats and applications above referred to.[c]

Sixth The Company further agrees out of its first net earnings, remaining after reserving fifty thousand dollars, or so much thereof as may be required to repay the sums paid in cash by the subscribers to its Capital Stock, to pay to the said Edison the further sum of one hundred thousand dollars in cash, and thereafter to pay him an annual royalty upon every light licensed or used with its consent, under any of the patents of said Edison, of five (5) cents per light; and guarantees to pay in each year royalties to an amount not less than fifteen thousand dollars a year, if it has net income to that amount in that year from any source, provided however, that the Company shall have the option, by notice given on the first of January in any year, to pay thereafter a yearly commutation of thirty thousand dollars, in lieu of all royalties derived under patents of the United States and Canada; and the like option, upon similar notice, to pay thereafter annually the sum of twenty thousand dollars in lieu of all royalties or income derived under patents, grants, concessions or other rights secured to it in the other States or Countries above named.[c]

Seventh The Company hereby covenants with the said Edison that it will, in so far as the same may be practicable and economical, seek with diligence and good faith to introduce, as extensively as possible, in all the countries named in this agreement, the Electric Light produced by means and apparatus invented by said Edison, as well as to bring all such means and apparatus into like use for all the other purposes contemplated by this agreement.[c]

Eighth The said Edison agrees, at the request of the Company, and at its expense, to execute and deliver, from time to time, such writings of further assurance, or such separate instruments making special assignments of the interest or any portion thereof conveyed hereby, or such special powers or authorities as for its convenience or interest it may desire to have separate from the general body of stipulations herein contained.[c]

Ninth The several agreements and convenants of the parties hereto shall bind, and shall enure to the benefit of, respectively, the executors, administrators and assigns of Edison, and the successors of the Company.[c]

In Witness whereof[d] the party of the first part has hereto set his hand and seal, and the party of the second part has hereto caused its corporate seal to be affixed, and its corporate name to be subscribed, the day and year first above written.[b]

The Edison Electric Light Company
by Norvin Green Prest.[e]
Thomas. A Edison[e]

Signed, sealed and delivered in the presence of
Francis R. Upton[f]
Charles Roth[1]   Attest[g] C. Goddard, Secy

DS, NjWOE, Miller (*TAEM* 28:1162). Notarization omitted. [a]Place taken from oath; date taken from text, form altered. [b]Followed by line to right margin. [c]Followed by line to right margin and two centered horizontal lines. [d]Underlined twice. [e]Followed by wax seal. [f]"Signed . . . Upton" spanned by brace at right. [g]Preceded by wax seal.

1. Charles Roth was an attorney at 3 Broad St., the same address as Porter, Lowrey, Soren & Stone. Wilson 1879, 1252; see Doc. 1494 n. 1.

-1577-

Technical Note: Electric Lighting

[Menlo Park,] Nov 15—78

Elect Light[a] Law—[1]

With a given wire having 1 ohm resistance & certain length brought to a given degree temp. by given battery. It will when coiled in such a manner that but one quarter of its surface radiates its temperature will be increased 4 times or:—¼ gbattery will bring it to temperature of straight wire Or same battery ~~with 4 ohms~~ including wire whose total resistance is 4 ohms is[b] inserted will bring it to the same temp. as straight wire[c]

This was actually determined by trial

The amount of heat lost by a body is in proportion to the radiating surface of that body. If one square inch of platina be heated to 100 deg it will ~~lose its~~ fall to say zero in one second whereas if it was at 200 deg it would require 2 second

Hence in the case of incandescent conductors if the rading surface be 12 inches and the temperature on each inch be 100 or 1200 for all if it is so coiled or arranged that there[d] is but ¼ or 3 inches of radiating surface then the temperature on each inch will be 400. & if reduced to ¾ of an inch it will have on that ¾ 1600 deg fahr notwithstanding the original total[c] amount was but 12 because the radiation has been reduced to ¾ or 75 units ~~have~~ hence the effect of the lessening of the radiation is to raise the temperature of each remaining inch not radiating to 125 deg=

if the radiating surface was reduced to 3/32 of an inch the temperature would reach 6400 deg fahr ~~since of course~~ to carry out to the best advantage this law in regard to platina etc then with a given length of wire to quadruple the heat ~~and le~~ we must lessen the radiating surface to[e] ¼ & to do this in a spiral ¾ must be within the spiral & ¼ outside for radiating= hence a square wire or other means such as a spiral within a spiral must be used.

These results account for the enormous temperature of the Electric arc with one horse power as for instance if 1 hp will heat a ~~foot~~ 12 inches[f] of wire to 1000 deg fahr.[d] & this concentrated to have ¼ of the radiating surface it would reach a temperature of 4000 deg or sufficient to melt it but supposing it infusible the further concentration to ⅛ its surface ~~or ¾ of an inch~~ it would reach a temperature of 16 000 & to 1/32 its surface which would be about the radiating surface of the Electric arc it would reach 64 000 deg fahr, of course when light it radiated in great quantities [—][g] not quite these temperatures would be reached—

~~from this~~

Another curious law is this ~~in the If~~ it will require a greater initial battery to bring an iron wire of the same size and resistance to a given temperature than it will a platinum wire, in proportion to their specific heats, and in the case of Carbon if a peice of Carbon 3 inches long ⅛[d] diameter with a resistance of 1 ohm, it will require [~~unif~~ ~~an~~?][g] a greater battery power to bring it to a given temperature than it would a cylinder of thin platina foil of the same length diameter & resistance because the specific heat of Carbon is many times greater, besides If I am not mistaken the radiation of a roughened body for heat is greater than a polished one ~~wh~~ like platina which may be polished.

A gas jet equals a Jobhlkoff Candle when concentrated in the same space=

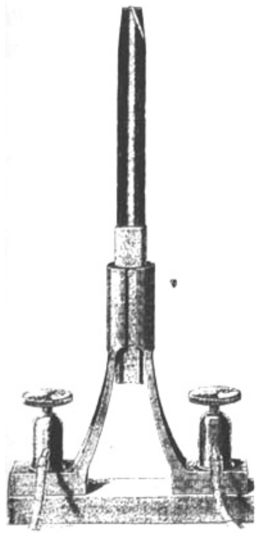
A gas jet has—

10[d] square inches ~~in a gas jet~~ radiating surface—[h]	15 candle p.
if reduced to 52½ "	60
~~662~~ .62 "	240.
~~0.31~~ .15, "	960.

The latter radiating surface is about equal to the radiating surface of the arc of a Jobelkoff Candle, hence an ordinary gas jet if concentrated to the size of the Jobelkorf arc would give the same light, or in other words the same power which gives a gas jet of 15 candle power will give 1000 by concentration.[2]

If the radiating power or time of a substance is decreas~~ing~~ed= the gain in light is directly to the decrease for instance if I could with platina coils obtain 4 burners of 15 c.p. each per hpower then by reducing the radiating[e] power 50[d] per cent. I would obtain 8 burners—

Chas Batchelor



A Jablochkoff "candle," of two carbon rods with kaolin between, and holder.

X, NjWOE, Lab., NS-78-005 (*TAEM* 7:844). [a]"Elect Light" written by Batchelor. [b]"including . . . ohms is" interlined above. [c]Paragraph written by Batchelor. [d]Obscured overwritten letters. [e]Interlined above. [f]"12 inches" interlined above. [g]Canceled. [h]"radiating surface—" interlined above.

1. Edison copied into this Cat. 994:205–7, Lab. (*TAEM* 3:272–73). Calculations and notes that appear to be related to the development of Edison's "law" are in Vol. 16:223, 225–26, 231, 261–69, Lab. (*TAEM* 4:664, 666–67, 672, 700–8).

2. In a note dated 2 November Edison also treated the Jablochkoff candle as equivalent to sixty-six gas burners and his own electric lamp as equivalent to six gas burners. He claimed that his lamp would cost eight cents per ten hours while the Jablockhoff would cost thirty-two cents per ten hours (NS-78-005, Lab. [*TAEM* 7:842]). Cost calculations are also in Vol. 16:268, Lab. (*TAEM* 4:707).

-1578-

Technical Note: Telephony[1]

[Menlo Park,] Nov 15th 1878

New Receiver

Have been testing transmitters today and find the sudden decrease in the volume of sound is caused by the adjustment of transmitter— ~~when~~ I took transmitter when could get but very low talking and changed adjustment until~~t~~ it came good again and it stood that way for half an hour when it suddently went very low and I adjusted transmitter again and it went bang up again— ~~I~~ [~~alter it tried~~?][a] think it is a buckle in diaphram— have left it for new diaphram[b]

Put two instruments in circuit one at each end and got splendid speaking—not quite as loud as when one is in singley[b]

Notice quite some noise from Cog wheels in Box—and suggest friction rollers[c]

Chas. P. Edison

X, NjWOE, Lab., Vol. 18:92 (*TAEM* 4:1127). Written by Charles Edison; unrelated doodles not transcribed. [a] Canceled. [b] Followed by centered horizontal line. [c] Followed by centered horizontal flourish.

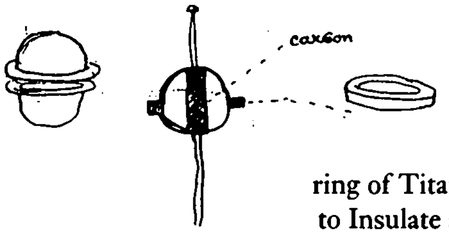
1. This note is a continuation of Doc. 1575.

-1579-

Technical Note: Electric Lighting

[Menlo Park,] Nov 20 1878

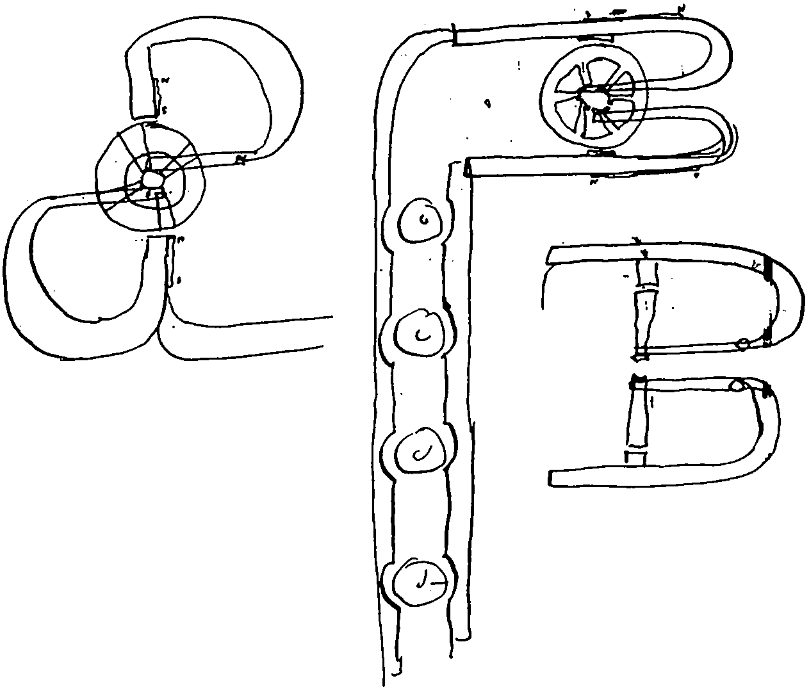
Electric Light



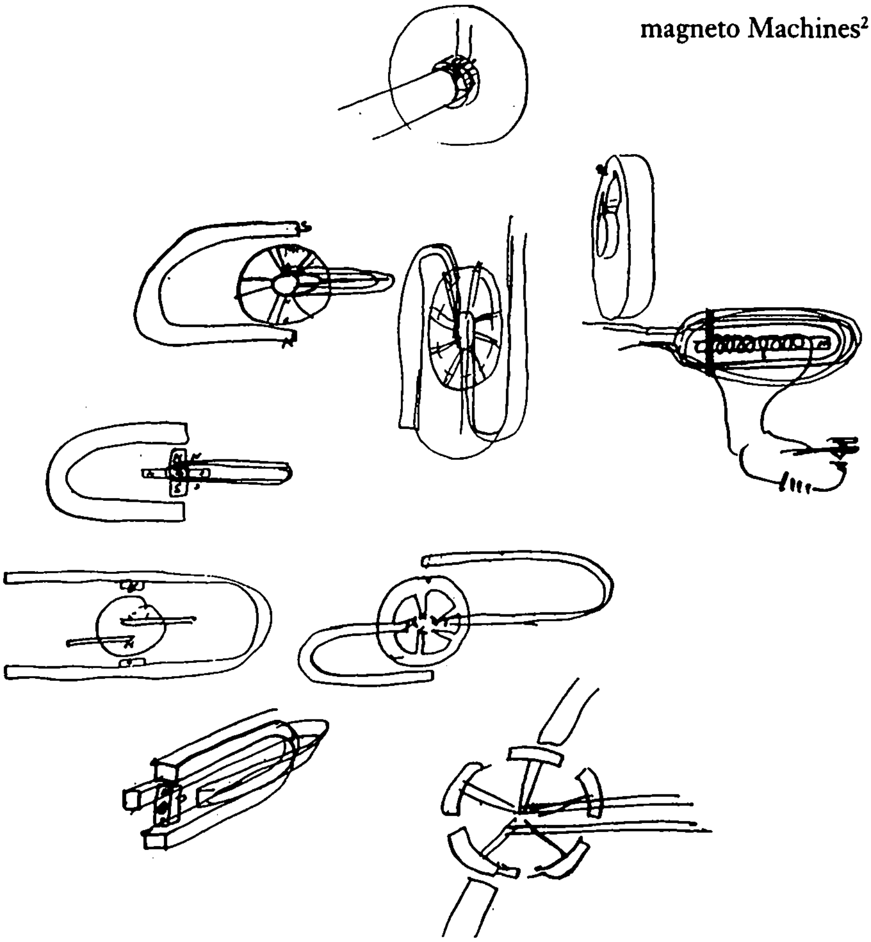
Carbon
ring of Titanic oxide (rutile)
to Insulate and short circuit
when hot by becoming a Conductor

The globe is of Platinum—becoming incandescent by radiation & Conduction—Oxygen is prevented from access to Carbon.[a]

I propose to make a machine that will generate large quantities of Magnetism by power[b] as the present dynamo machine generates Electricity & use the magnetism for field magnets for a number of Magneto[c] Electric Machines.[1]



magneto Machines[2]



T A Edison
M N Force

Chas Batchelor
J Kruesi
Wm Carman

X, NjWOE, Lab., Vol. 16:282, 281 (*TAEM* 4:722, 721). Document multiply signed and dated. [a]Followed by centered horizontal line. [b]"by power" interlined above. [c]Obscured overwritten letters.

1. Magnetic poles are labeled "N" and "S" in drawings. In late December Edison executed a provisional British patent specification covering, in part, a mechanical means of increasing magnetism in dynamo field magnets. In the specification Edison claimed to have dispensed with

> the use of helices around the field of force magnets; hence the electric current that is developed in the magneto electric machine can be entirely employed for lighting and other uses outside of the machine, instead of a portion being used to develop magnetism.
>
> When a piece of steel is brought within the magnetic field of a permanent magnet the same becomes a magnet. I arrange a ma-

> chine so that the induced magnetism re-acts upon the permanent magnet to increase its power, and thus develop magnetism by mechanical force in a manner somewhat similar to the development of electricity in a magneto electric machine.
>
> One of the devices I have employed consists of a shaft having radial bars, which is revolved with the ends of the bars as near as possible to the poles of permanent magnets, and the other poles of the magnets being adjacent to the hub or near the other ends of the bars. In their revolution the bars become magnetised, and increase the magnetism in the permanent magnets until the maximum magnetism is developed.

A draft of the provisional patent specification, dated 28 December (it issued on 28 June 1879 as British Patent 5,306 [1878]), is in Miller (*TAEM* 28:1172). Francis Upton's sketches, probably made in late December, of several forms of a "magneto multiplier" are in N-79-03-20:10–27, 71–73, 85; N-78-12-20.1:66–69; both Lab. (*TAEM* 33:7–15, 36–37, 42; 30:148–49).

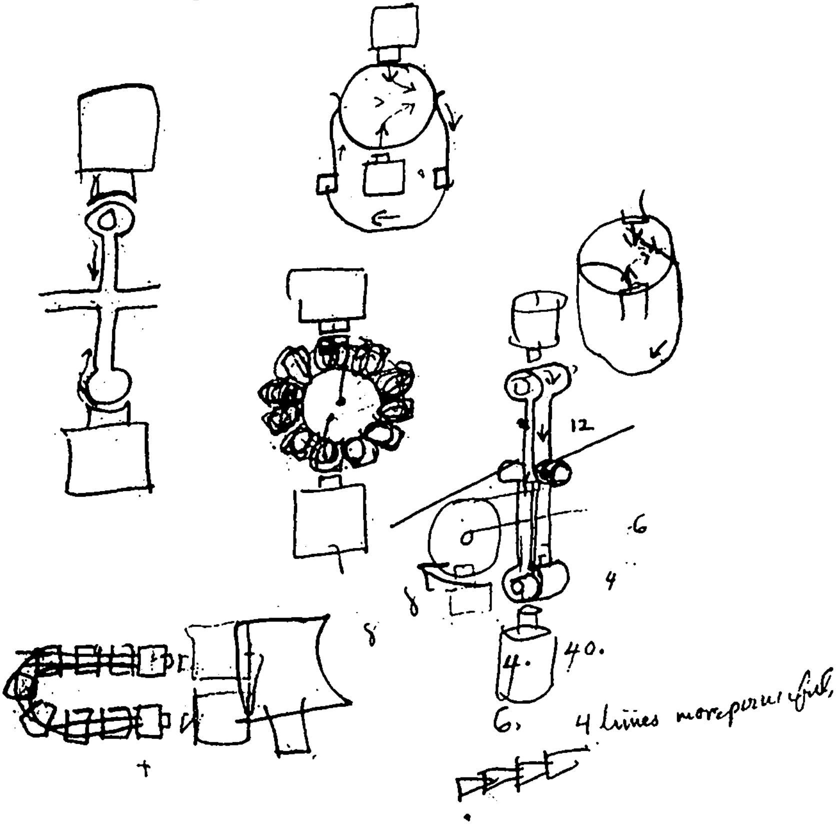
2. The first sketch below appears to be a disk dynamo (see Doc. 1580 n. 1).

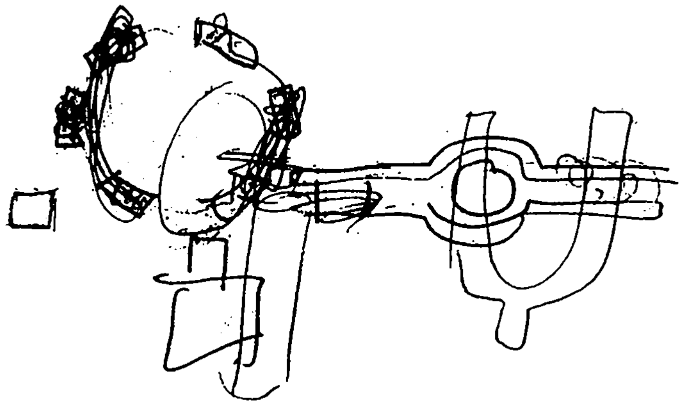
-1580-

Technical Note: Electric Lighting

[Menlo Park,] Nov 20. 1878[a]

Electric Light[1a]





TAE
M. N. Force

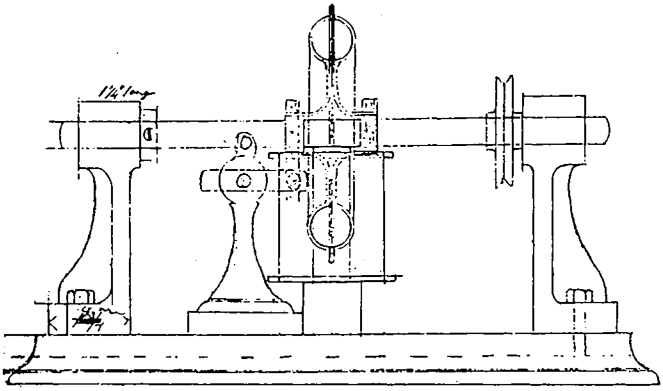
Chas Batchelor
J Kruesi
Wm Carman

X, NjWOE, Lab., Vol. 16:279 (*TAEM* 4:719). [a]Written by William Carman.

1. This page of drawings shows a variety of arrangements for the armatures and field magnets of electric generators. Two of the drawings appear to be related to measured drawings of 17 November (Vol. 16:271–72, 274, Lab. [*TAEM* 4:711–12, 714]). These drawings, labeled "Edisons Dynamo electric machine," and an account entry which begins on 22 November suggest that the machine was actually built (Ledger #3:90, Accts. [*TAEM* 87:90]). Edison based his design on the eddy current phenomenon initially explored in a famous experiment in 1824 by the French scientist François Arago and explained by Michael Faraday. That is, that the motion of a copper mass in a magnetic field creates currents of electricity in the copper (Faraday 1965, Series I, Section 4). Edison acknowledged his debt to Arago in his December British provisional patent specification (No. 5306 [1878]):

> I employ copper rings or segments around an iron core, and I use mechanical revolution, whereby the electric action, developed upon the general principle of the copper disc between two magnetic poles, as experimented upon by Arago, is converted into a continuously flowing electric current.

A measured drawing of Edison's disk dynamo design from November 1878.



-1581-

Technical Note: Telephony

[Menlo Park,] November 20th 1878

[New][a] Receiver Experiments for the 21st[b]

wet button through and see if it will do any good to put in resistance in line[b] ⟨better when none⟩[c]

make wooden sleeve instead of Brass one now used and see if can get current when wet—[b] ⟨~~Cant get it~~ ~~Cant~~ Can just hear it when wet⟩[c]

see if the receiver works better if the transmitter is adjusted with more resistance when the button is wet—[b]

take button wood ½ inch dia and [-][d] mold about½[a] inch plaster paris on out side moisten with caustic and try—[b]

try the above with brass core instead of wooden one—[e]

~~try~~ find resistance of button when wet through ~~with~~[b]

also resistance when dry—[b] ⟨2000 ohms⟩[c]

Chas. P. Edison Chas Batchelor
M. N. Force J Kruesi

X, NjWOE, Lab., Vol. 18:74 (*TAEM* 4:1109). Written by Charles Edison. [a]Page torn. [b]Followed by centered horizontal line. [c]Marginalia written by Charles Edison. [d]Canceled. [e]Followed by centered horizontal line and by the numeral "4" repeated and several words (e.g. "Tran," "Transfer," "Thomas," and "Robart") written as doodles, probably by Charles Edison.

-1582-

From George Barker

Philadelphia, Nov. 22d 1878.[a]

My dear Edison:—

I have been so busy with my lecture that I have not had time to write and thank you for the things you were so kind as to send me and which I found here on my arrival home from Menlo. They will afford me some excellent illustrations in my lectures to my classes.

As to the lecture, everybody says it went off well, though I was not satisfied. Not less than six different things which I had expected to have, disappointed me. The Brush people for example, after asking a month before the lecture, the privilege of putting in one of their machines and lighting up the Academy for me,[1] and after several conferences in which all the details were arranged, sent me word 24 hours before the lecture, when it was too late to make other arrangements, that they had decided not to do anything! The Brush machine people are not, in my judgment, not always fair in their statements or scrupulous in their dealings. You are mistaken as to their lamp being the Serrin.[2] The Serrin is a clock work lamp, better in many respects then theirs which is in principle, patterned[b] after Browning's,[3] though not as efficient. I have them both. Of course all[c] this is in confidence between us. You know probably that the Brush machine has been lately changed in its connections, so as to give a current of sufficiently high electromotive force to run four or five lights in series, as the Wallace machine does. This looks as if they were not satisfied with their machine as it was, and so have adopted Wallace's principle. Wallace received gold medals at Boston and at Baltimore for his machine.[4]

The fragments from bottle 49 of your mineral collection, which I brought home, I gave to one of our best chemists in the University and he pronounced it carbon, from a coke oven probably; from which it got its mammillated appearance.

As to your new light, I did not at all expect you to let me have it under the circumstances. My telegram to you was at the suggestion of the manager. I did not care to postpone.[5]

Prof. Farmer sent to me and I suppose he sent to you the other day, a slip from the Salem Observer, containing a letter from him on electric lighting by means of platinum.[6] He lighted the parlor of[d] his house all the month of July 1859 with platinum lights and they were perfectly soft and delightful. He has lighted 42 platinum lamps in one circuit & that of a not very large machine. He has got the figures of the current strength necessary to maintain any piece of platinum at its fusing point, down to dots![7] He can calculate exactly the power required to maintain a thousand of your lamps at their maximum, if you will give him the resistance of one of them. Did you ever see or hear about his ingenious self-acting rheostat, with a balance governor, for preventing the fusion of the platinum? While I believe that your method is vastly superior to his, yet I think his might prove a good thing in certain circumstances.[8]

I hope you will be ready to make your light public before Dec. 5. Prof Draper has a scientific soiree that evening and I would like to have him have one lamp.[9]

Has any description of your new receiving telephone been published? I would like to make and use one, if there is no objection. When will you have yours completed? Excuse my long letter & believe me Cordially yours

George F. Barker.

Professor Dana thanks you for your Tasimeter article.

ALS, NjWOE, DF (*TAEM* 17:1048). Letterhead of University of Pennsylvania. [a]"Philadelphia," and "187" preprinted. [b]Obscured overwritten letters. [c]Interlined above. [d]"the parlor of" interlined above.

1. Charles Brush's arc lighting system soon became one of the most commercially significant. In his lamps, Brush employed a gravity-feed to control the arc gap. As the fixed lower carbon burned away and the gap between it and the upper carbon increased, so too would the resistance, thus diminishing the current flowing through the electromagnetic regulator. This caused the upper carbon to gradually descend by its own weight until the two carbons touched, thus increasing the strength of the circuit and causing the regulator to separate them the proper distance. Brush also developed an automatic regulator to allow a variable number of lamps to be run by his generator. Regarding the Brush dynamo see Doc. 1489 n. 4; Dredge 1882–85, 1:204–18, 422–30.

2. V. L. M. Serrin employed a weight-driven ratchet and pawl mechanism to regulate the amount of current flowing through the electromagnet used to maintain a constant distance between the carbon rods. The main advantage of his design, developed between 1857 and 1859, was that it compensated for the different rates at which the positive and negative electrodes burned, keeping the arc in the same position relative to a shade or reflector attached to the lamp. Bowers 1982, 102–3; Dredge 1882–85, 1:395–96, 399–400.

3. Unidentified.

4. Presumably at the Mechanic's Fairs held in those cities a few months earlier (see Doc. 1450 n. 5).

5. Barker's telegram has not been found. On 10 November he wrote Edison that he had seen Mr. Pugh, the lecture manager, that day, who "says if you can promise me your new light in 30 days, he thinks it would be worth while to postpone my lecture for a month in order to get it." Barker added that he was "very anxious to give the lecture importance by bringing out what everybody is so much interested in. Please tell me frankly exactly how you feel about the matter yourself. When everything is secured, I suppose the Company will not object." A notation on Barker's letter indicates that Edison wired a reply, which also has not been found. DF (*TAEM* 17:1031).

Barker reportedly told his lecture audience that although he had hoped to demonstrate Edison's electric light, the inventor's London attorney had advised against making it public for another twenty days. He did state, however, that

> within a week I have visited Menlo Park, and after a thorough examination of Mr. Edison's discovery I can say that the problem has been solved, and that Mr. Edison can place on every gas bracket and on every chandelier burners which will give a brilliant white light, safe, pleasant, beautiful, and at about one-third the cost now charged for gas. The practicability of the scheme is beyond question. ["The Electric Light," *New York Herald*, 22 Nov. 1878, 4]

6. This article was excerpted in the *American Journal of Science*, also known as *Silliman's Journal*.) Defendant's Exhibit Silliman's Journal Article, *Sawyer & Man v. Edison (U.S.)*, (*TAEM* 47:916).

7. By playing on the word "dots" as a reference to decimal points and a slang term for money, Barker may have been alluding to both the precision of Farmer's calculations and Farmer's comparison of gas and electric lighting costs. Partridge 1984, s.v. "dots."

8. See Doc. 1479 n. 1.

9. On 29 November, Draper invited Edison to the 5 December meeting of the "Thursday Evening Club" at his home. Draper planned "to do a few simple electric light experiments and if your new lamp is ready for the public I should like very much to have one. Barker will be here & we can manage to amuse ourselves with my Gramme & petroleum engine." At 1:30 P.M. on the afternoon of the meeting Edison wired Draper, "My light people forced engagement on me for tonight hence cannot come am very sorry." DF (*TAEM* 16:492, 17:1073).

-1583-

From Uriah Painter

[New York,] Satdy 3 PM [November 23, 1878][1]

Dr E

Got complete possession of ESP Co— Put EHJ—W E Chandler[2] & JCR in board— These with you & I make 5 out of 9—

Made new Ex[ecutive] Com— UHP—EHJ & G G Hubard!!!—

Explained fully the Pat' situation to EHJ— Is too long to write. He will see you on Monday—

Your interests are well seen to!!

UHP

ALS, NjWOE, DF (*TAEM* 19:157).

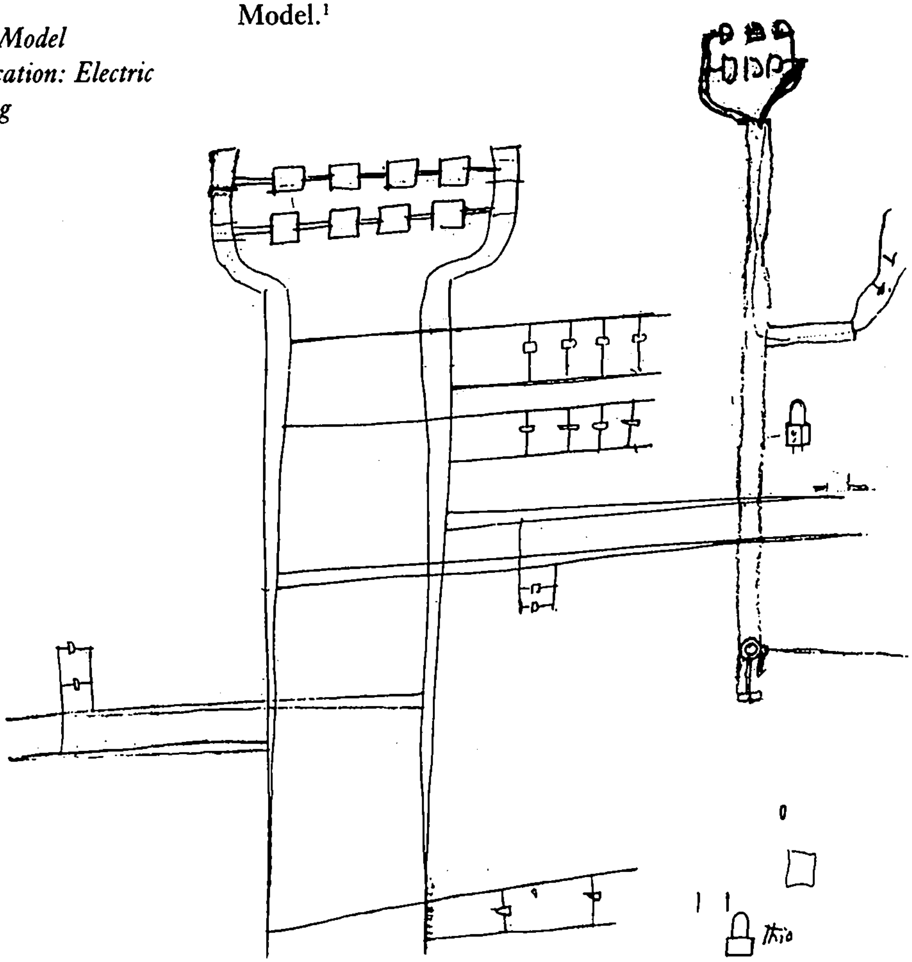
[1] The date of the Edison Speaking Phonograph Co. special stockholders' meeting, 23 November, fell on Saturday. Edward Johnson to TAE, 13 Nov. 1878, DF (*TAEM* 19:150).

[2] Probably William Chandler, a former assistant secretary of the treasury, who at this time was a Washington attorney and prominent figure in the Republican Party. Chandler later became Secretary of the Navy and a U.S. Senator. *NCAB* 4:252; *DAB*, s.v. "Chandler, William Eaton."

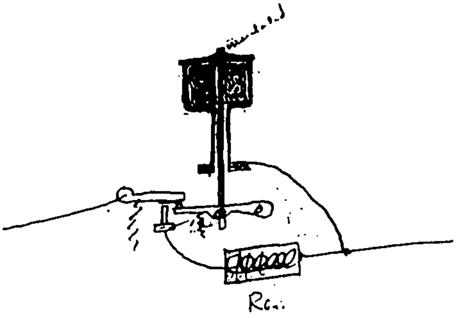
-1584- [Menlo Park,] Nov 23 1878

Patent Model Specification: Electric Lighting

Model.[1]



Kruzi. I will give you another Lamp to show on this model.[2]
Electric Light Model.[3]



This lamp to go in Kruzi Model given to Griffin "esq"[a]

TAE Chas Batchelor
M N Force J Kruesi
Wm Carman

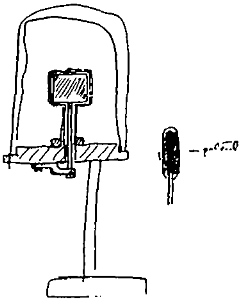
X, NjWOE, Lab., Vol. 16:290, 289 (*TAEM* 4:729, 728). Document multiply signed and dated. [a]Underlined twice.

1. This model was for a patent application that Edison executed on 28 January 1879 and which issued as U.S. Patent 227,228 on 4 May 1880 (cf. Vol. 16:307, Lab. [*TAEM* 4:743]). The model is at the Edison Institute. Edison described his circuit arrangement as follows:

> A is a tube laid in the earth, and preferably of iron, and it forms, together with the earth, one-half of the circuit. Within this tube is an insulated conductor, B, preferably of a number of strands of copper twisted together in the form of a cable, one strand of the cable being dropped, say, every one hundred feet, so that at the extreme end of the circuit there shall be but a single strand. This cable is insulated from the tube by any cheap or economical insulation, such as tar or asphaltum.
>
> A branch tube, A^2, containing a single strand from the cable, is to enter each house or building, and from the basement smaller wires are run to the various parts of the house where the lights are required. Each lamp is to be provided with a switch, 2, so that it may be disconnected from the conducting-wires.
>
> The electric generators at the central station are provided with constant field-of-force magnets, the helices of which are in the electric circuit; hence if all the lamps feeding from the main conductors are disconnected by their switches the circuit will be broken and no current passes through the conductors leading from the station to the lights, and the steam-engine runs lightly and with the expenditure of a very small amount of force. If now the switch of a single lamp is turned the lamp is connected to the branch wires from the main conductors, the circuit is closed, and only sufficient current passes from the central station to supply that lamp, because the external resistance determines the amount of current. In this way the current will be proportioned to the number of lamps in the circuit.

After describing the lamp regulator, Edison went on to say that

> as the connecting of one or more lamps causes a sufficient amount of current to be developed at the central station to keep the same incandescent, it follows that if the machines at the station are arranged expressly for tension and quantity many hundreds of lamps may be placed in circuit between the main conductors, the reduction of resistance upon placing each lamp in the circuit drawing the proper quantity of current from the station; hence the greatest economy possible is obtained by causing all the resistance outside of the main conductors to be light-giving resistances.



Edison originally intended for this lamp design to be included in U.S. Patent 227,228.

2. The original lamp design intended for this patent is in Vol. 16:292, Lab. (*TAEM* 4:730).

3. Text is "insulated" and "Res." This lamp was included in Edison's U.S. Patent 227,228. In this design, Edison placed a bobbin of wire, having "preferably a resistance of one thousand ohms," in a metal case, which was rendered incandescent by the heat radiated from the wire. Edison insulated this wire "with a pyroinsulator, such as zircon, magnesia, lime, or other compounds of high fusibility." The use of pyroinsulators may be related to Edison's observation from the previous day, 22 November, regarding the fusibility of a platinum spiral embedded in plaster of paris and the possible use of zircon in place of platinum. The same day he started John Knight on a series of "Tests for Non Radiating Substances" that continued into early December. The exact nature of these experiments is unclear, but they involved measuring how readily certain materials radiated heat. In an undated December notebook entry, Edison suggested trying the "fusibility of pumice stone, also of Electro silicon, also oyster shells," among other possible insulators. The principle of the pyroinsulated bobbin was subsequently incorporated into other lamp designs and U.S. and British patent applications (see Doc. 1598 n. 1). N-78-11-22:1; N-78-11-21:3–23; N-78-12-15.2:1; all Lab. (*TAEM* 29:153, 230–40; 40:305).

-1585-

From Tracy Edson

New York Nov. 25th. 1878

My Dear Sir,

If I understood you correctly on Friday last,[1] you said your new Receiver would be six times as loud as any one now in use; that it could be made as cheaply as any other, (say for One Dollar each,) and that it would not infringe upon any other invention in existence for that purpose.

Also, that the Gold & Stock Tel. Co. could have it for a yearly Royalty of One Dollar on each one they use, with the option to use it or not as they please, and with the right at any time to fix a maximum Royalty at $3.000. per annum instead of the One Dollar per Instrument.

If the above is correct, please write me to that effect tomorrow,[2] and I will bring it before the Executive Committee at our next meeting which takes place on Wednesday this week, instead of Thursday— Very truly Yours

Tracy R. Edson

ALS, NjWOE, DF (*TAEM* 19:805).

[1] 22 November.

[2] No reply has been found, but see Doc. 1640.

-1586-

From Grosvenor Lowrey

New York, Nov 25th 1878[a]

My dear Edison:

I return the letter of Gen. Stone.[1] It merits an answer in your own handwriting. Besides I think that your letter and signature would be something very interesting to him and those with whom he is associated. I have no doubt it would pass from hand to hand and reach its place of final deposit in the archives of the Khedive.

In making your answer I suggest that you say to him that you desire to secure the exclusive privilege to use in the dominions of the Khedive all your various inventions and that it would be gratifying to you to ~~add to~~ have some share[b] in the progress which that interesting country is making under the government of the present illustrious Khedive. In return for this compliment you may get a concession which would be both honorable and profitable to you.

The visit of last Friday by Mr Banker and others of the Executive Committee had a most excellent effect.[2] They are now all full of courage and confidence. I have invited Mr Morgan[3] & Mr Fabbri to accompany me some day this week or next.[4] They will be very intelligent observers and it will be useful to them, in correspondence with foreign countries, to have seen what they are talking about in advance of your perfecting it. It is all the better that they should see the rubbish & rejected devices of one sort and another. Their appreciation thereby becomes more intelligent. Very truly yours,

G. P. Lowrey

LS, NjWOE, DF (*TAEM* 18:83). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted. [b]"have some share" interlined above by Lowrey.

1. Charles Stone had been a Union officer in the Civil War and then served in the Egyptian army from 1870 to 1883 as chief of staff (*DAB*, s.v. "Stone, Charles Pomeroy"). He wrote Edison on 3 November to ask about the practicality of the electric light. Stone offered to help Edison secure the rights to his light in Egypt "without desiring any pecuniary interest" for himself. He claimed to have "endeavoured to present and cause to be adopted, whatever of American inventions would tend to advance civilization here, without any personal interest, but simply with a desire to advance in Egypt the progress of enlightenment, so much desired by the Khédive" (DF [*TAEM* 18:85]).

2. James Banker, Tracy Edson, and other officers of the Edison Electric Light Co. had visited Menlo Park on 22 November. Edison Electric Light Co. to TAE, 19 Nov. 1878, DF (*TAEM* 18:71).

3. John Pierpont Morgan (1837–1913) was the senior partner in the New York banking firm of Drexel, Morgan & Co.

4. Lowrey arranged the trip to Menlo Park for 2 December but had to postpone it to 9 December (see Doc. 1612). Lowrey to TAE, 30 Nov. 1878, DF (*TAEM* 18:207, 210).

-1587-

From George Gouraud

LONDON. 26 Nov 1878[a]

T. A. Edison Esq.

Thanks for yours of the 11th enclosing Mr Henry Bentley's letter which shall have my best attention.[1] I am already well known to the Editor of The Times Mr Chenery[2] and thereby have the very best means of bringing this matter before The Times in the connection indicated for reporting Parliamentary Speeches and so on. Mr. Chenery was enormously pleased with the Telephone which he saw here. As soon as the new Receiver comes (which Adams's advises me will be now in a few days if they were shipped on the 20th inst.)[3] we will then go ahead vigorously. A passive policy has been indispensable in the light of your recommendations contained in your letter of the 14th Octr[4] we could only assume that to go on using the old Receiver would of necessity involve our claiming that we were free to do so and inferentially that anybody else might be. It is better to wait, though impatiently than to make a false start.

Electric Light

I have been much gratified at the good words received from you recently in your cables to Barrett who cabled you from this office.[5] Barrett came up on my invitation so that I might make his acquaintance) and is a capital fellow in every way just our man to use as a scientific man.

I have had a nice letter from Lowrey[6] but have nothing yet from either you or him showing exactly what[b] my status is in connection with the Light but feeling every confidence am quietly biding the time

per pro. Geo E. Gouraud J. E. Kingsbury[7]

LS, NjWOE, DF (*TAEM* 16:490). Note form of George Gouraud; note form is electric pen copy. [a]"LONDON," and "1878" preprinted. [b]Interlined above.

[1] Neither Edison's nor Bentley's letter has been found.

[2] Thomas Chenery was editor of the *London Times* from 1877 to 1884. He was also a noted linguist and had been professor of Arabic at Oxford. *DNB*, s.v. "Chenery, Thomas."

[3] No letter to Adams concerning this shipment has been found, but see Doc. 1551 n. 3.

[4] Doc. 1497.

5. In the two preceding weeks William Barrett had cabled several questions about the electric light and prepaid Edison's replies. In the first cable he asked "Do you actually accomplish increase and decrease electric light each burner independently Does alteration waste current." To this Edison replied, "Yes—no waste." Barrett followed this up by aking "Does altering one affect other lights same circuit" to which Edison responded "Not the slightest." Finally, he requested the approximate cost of Edison's system compared to gas and was told "Very much cheaper." In a newspaper interview, Edison cited Barrett's first two cables as an example of the incredulity with which other researchers treated his electric light claims. Barrett to TAE, 12, 14, 19, and 21 Nov. 1878; TAE to Barrett, 12, 14, and 22 Nov. 1878; all DF (*TAEM* 17:1036–38, 1044, 1047); "Invention by Accident," *New York World,* 17 Nov. 1878, Cat. 1241, item 1012, Batchelor (*TAEM* 94:411).

6. Lowrey's letter has not been found.

7. John Kingsbury was later connected with the Western Electric Co. in London. His book, *The Telephone and Telephone Exchanges: Their Invention and Development* (Kingsbury 1915), is an important source on telephone history. Nothing more is known of him. Samuel Insull to Kingsbury, 3 Apr. 1884, DF (*TAEM* 72:314).

-1588-

Grosvenor Lowrey to Stockton Griffin

New York, Nov 26th 1878[a]

My dear Griffin:

The agent of the North American Review came to see me by request of Dr Green, upon whom he had called. He said they were thrown into a great deal of embarrassment by disappointment in an article which was to be written by a Mr Johnson but was to be published as Mr Edisons article. That Mr. Edisons objection to giving any time to the matter now was that the stockholders would object to any description of his light or to any time spent upon magazine articles at this time. I asked the subject of the article. He said it was to be "Illumination in Cities." I asked if it was expected to include any special description[b] of electric lights. He did not know. Reflecting that it was desirable for the interests of Mr Edison rather than the Company to keep all these agen~~t~~cies of public opinion in their present well disposed mood towards him, I then said I thought there could be no objection to an article apparently by Mr Edison which should in general terms speak of illumination; and Electric lights specially; but that he could not expect any, even the slightest descriptions of Mr Edisons methods. He said at once that that was all they wanted to keep their promise to the public by something germane[b] to that subject, which should seem to come from Mr Edison.

Mr Upton was present and turning to him I asked whether his researches might not have given him a few interesting points in the history of electrical inventions which could be spread out thin and help to make a magazine article. He thought that might be easily done. The factotum then said that was all he wanted of Mr. Johnson (and I was unable to learn from him whether it was your friend Johnson, although he said it was the same who wrote the article on the Phonograph) to work up the facts. These were then to be revised by some sub-editor and then the whole should be submitted to you & to me before publication.[1]

He seemed greatly gratified at this chance of an article, although as I said to him it appeared to me it would be of little value with all the restrictions that would be put upon it. My advice therefore is that Mr Edison should read over any article submitted to him, strike out freely and qualify wherever this shall appear proper. Of course he would not allow anything to be said ~~by us~~ except what any stranger could say from reading ~~any~~ the[c] newspapers.

I shall go out by the 11 oclock train tomorrow, I think, bringing Mrs Lowrey and one of my boys Very truly

G. P. Lowrey

P.S. The two-Yonkers Gas Companies one owned by Wm Astor, solely are in the field with a proposition to be the pioneer be introducing your light. They have seen Fabbri & impressed him decidedly. (see A)[d]

(PS) A We have now got the new Spanish law and I have told Mr Navarro that I will let him have Porto Rico also and the patents will be taken out[b] in your name so that you will have the control of them.[2]

a person came in and handed me these enclosures for you thinking they would be useful to you as a mechanic[3e]

LS, NjWOE, DF (*TAEM* 18:88). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted. [b]Obscured overwritten letters. [c]Interlined above. [d]Paragraph written by Lowrey. [e]Paragraph written in an unknown hand.

[1] On 23 November, Rockwell Kent, Lowrey's secretary, had written Stockton Griffin to "remind Mr Edison of the conversation that was had in regard to the North American review people and say that he [Lowrey] thinks it advisable to favor them as much as possible" (DF [*TAEM* 18:82]). The same day as Lowrey's letter to Griffin (26 November), Edward Johnson wrote Edison that "Mr [Lorettus Sutton] Metcalf of the N. Amn Review is after me again" to write an article on the electric light under Edison's signature. According to Johnson, Metcalf claimed to have approval from Norvin Green and Grosvenor Lowrey,

with Lowrey having "agreed to notify you of the removal of embargo" on such publications. Johnson said that the *North American Review* seemed anxious to print the article, which he thought "would remove any lingering doubt as to the Bonafide nature of your efforts" (DF [*TAEM* 16:484]). A few days later, Johnson wrote again about this matter (on the letterhead of Lowrey's firm).

> You replied as to the social but overlooked the business This is not your wont— Hence I conclude you wish me to consider your former decision in reference to Electric Light article as sufficient—& to be final—but unfortunately I am pressed by Metcalf in such way that I cannot say no—without some authority from you for so doing— [Johnson to TAE, 29 or 30 Nov., DF (*TAEM* 17:257)]

Johnson asked Edison to telegraph that evening C.O.D., but no reply has been found. However, the *North American Review* did not run such an article until 1880 at which time it was written by Francis Upton under Edison's byline (Edison and Upton 1880).

2. After telegraphing to Havana and learning "that the special patent for Cuba is still issued as before," Navarro applied for patent protection there in Edison's name. Lowrey to TAE, 16 Nov. 1878, DF (*TAEM* 18:198).

3. The enclosures have not been found.

-1589-

Notebook Entry: Electric Lighting

[Menlo Park,] Nov 28. 1878[a]

Costs

San Fran uses 500,000,000[b] per year if this was burned in burners consuming 5 feet per hour, ~~each~~ 10 hours per day then 1 burner 20 days per 1000 or 500 burners, 20 days. 1,000,000. feet would supply 1000 burners, or 500,000 jets would burn up the entire product in 20 days, or 250 000 in 45 125 000 in 80 62,500 in 160, 31,250 burners in 320 days, hence I think there is 90,000 burners in use.[1c]

TAE

X, NjWOE, Lab., N-78-11-28:1 (*TAEM* 29:19). [a]Date written by William Carman. [b]Final "000" interlined above. [c]Edison's rough calculations follow.

1. In a confidential letter to Edison on 11 November, the mayor of San Francisco, A. J. Bryant, stated his belief "that municipal corporations are too much at the mercy of those who supply them with articles of necessity like water and light, and that they should own as far as possible the sources of water suppply and the means of illumination." Bryant wanted information "on the subject of supplying this city with Electric Light with the object of obtaining from you for the city, when you are ready to sell it, the exclusive right of using the light within its boundaries." According to Bryant's reply of 29 November, Edison wrote him on 20 November asking permission to direct Bryant's request to Grosvenor Lowrey. DF (*TAEM* 17:1034, 1057).

Edison had received at least one earlier inquiry about municipal lighting. In October, a Louisville physician wrote that he had "for months been opposing the exorbitant charges amounting to extortion" levied by the local gas company. He asked Edison to advise "as to the practicability of trying your discovery here" because the city was "almost ready for anything rather than longer submit quietly to the extortion of the Gas Co." Edison's marginal notation indicates that he asked about "the falls and the mill" opposite the city. George Griffiths to TAE, 24 and 30 Oct. 1878, DF (*TAEM* 17:992, 1017).

Charles Batchelor also clipped several newspaper items critical of gas companies in November and December. One, an editorial entitled "Revenge is Sweet," declared that even though Edison had already earned public respect, "when he announced his discovery of a method by which electricity could be used to light cities and houses as a substitute for gas, admiration turned to reverence and gratitude and his fame became as enduring as the hills." The writer imagined

> that there is more enthusiasm over the fall of gas stocks than over the rise of a new and better illuminator. Whether Edison succeeds in the perfecting of his invention or not, he will be hailed and remembered as a public benefactor if he does no more than give the mass of his countrymen an opportunity to enjoy the anxiety, nervousness and unhappiness of the gas companies. To see them squirm and writhe is a public satisfaction that lifts Edison to a higher plane than that of the wonderful inventor and causes him to be regarded as a benefactor of the human race, the leading deity of popular idolatry. [*Brooklyn Daily Eagle*, 1 Dec. 1878, Cat. 1241, item 1072, Batchelor (*TAEM* 94:438)].

A month earlier, Batchelor had cut out a cartoon expressing similar disdain for the gas interests. Captioned "The Edison Electric Light and the Silly Birds," the drawing represented gas companies as disoriented birds flying aimlessly at night around an intensely illuminated lighthouse. *New York Daily Graphic*, 2 Nov. 1878, Cat. 1241, item 993, Batchelor (*TAEM* 94:403).

-1590-

Notebook Entry: Electric Lighting

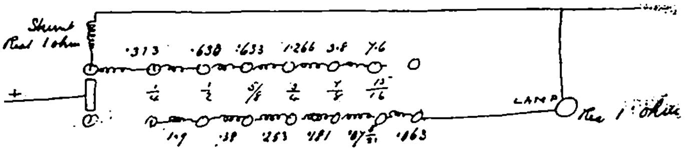
[Menlo Park,] Nov 28th 1878.

Electric Light

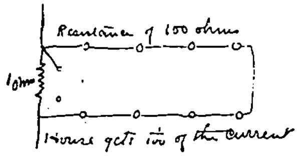
Sawyer-Man Light

1 Incandescence of Carbon in pure N

2 Uses[a] a switch for putting on current gradually same switch also divides the current between the lamp and ~~an equ~~ a resistance so:—[1]



Scientific American Dec 7 1878.[2]



Remarks

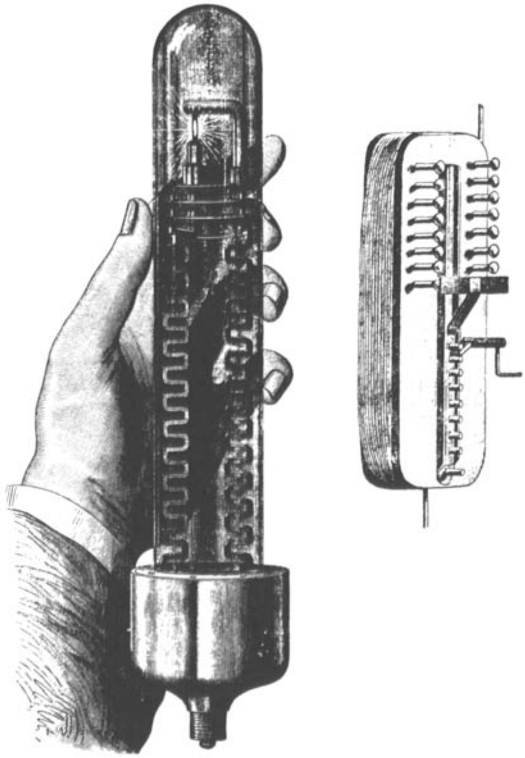
1 It will evidently supply current (whether it is being used or not) to the same amount.

2 If worked for quantity it would want enormous large conductors owing to the small resistance in each carbon

Chas Batchelor

X, NjWOE, Lab., Cat. 1304:2 (*TAEM* 91:4). Written by Batchelor. [a]Obscured overwritten letters.

1. Text is (left) "Shunt Rest 1 ohm" and (right) "LAMP Res 1 ohm." Numerals are (left to right): (top) ".313," ".630," ".633," "1.266," "3.8," "7.6"; (center) "1/4," "1/2," "5/8," "3/4," "7/8," "15/16"; (bottom) "1.9," ".38," ".253," ".181," ".07 5/21," ".063." Batchelor's drawing is adapted from figure 5 of an article on the electric light research of William Sawyer and Albon Man which appeared in the 7 December *Scientific American* (39:351, 354–55); actually published about 27 or 28 November. Sawyer and Man designed their switch to protect the carbon burner in



The Sawyer-Man electric lamp (left). The switch for a Sawyer-Man light (right).

their lamp from heating too rapidly. The contact at left between posts 1 and 1 was moved successively between terminal pairs to the right, diverting a fraction of the current from the shunt at the upper left to a lamp of equal resistance in the lower right corner. The lamp and shunt circuits were proportioned so that the resistance of the complete apparatus remained constant at all times. "The Sawyer-Man Electric Lamp," Cat. 1241, item 1044, Batchelor (*TAEM* 94:429).

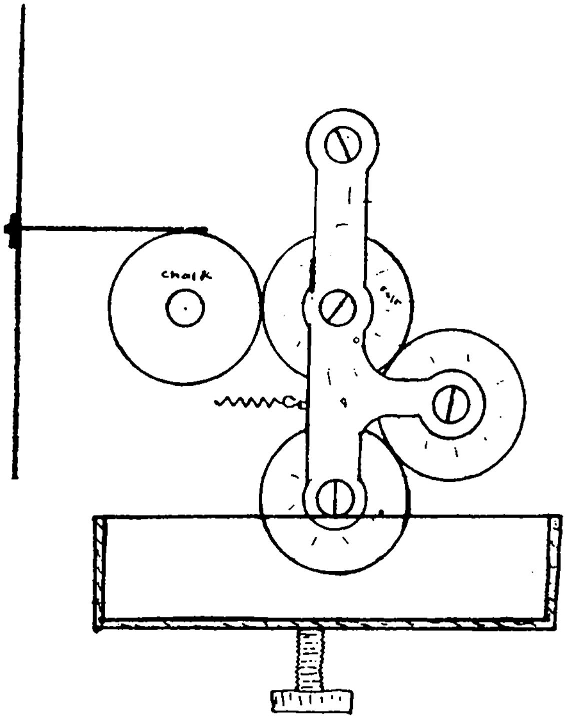
2. Batchelor copied this diagram from figure 7; however, he left out the diagonal line at bottom left corresponding to the one at top left. Text is "1 ohm," "Resistance of 100 ohms" and "House gets 1/100 of the current."

-1591-

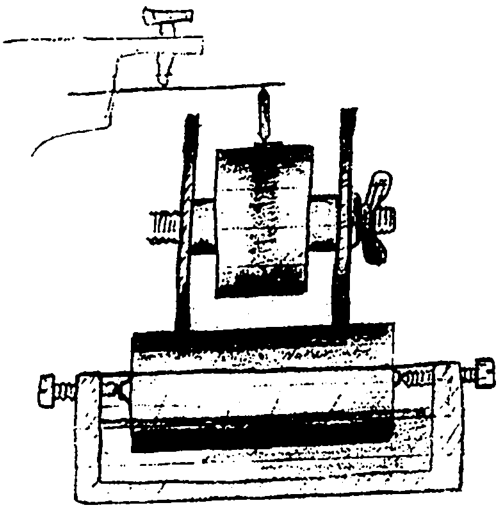
Technical Note: Telephony

Menlo Park, N.J.,[a] Nov 28th 1878

New Receiver[1]



For regulating moisture of Button.



Felt roller feeds water on Plaster Paris discs.[2]

Chas P. Edison

X, NjWOE, Lab., Vol. 18:97 (*TAEM* 4:1131). Written by Charles Edison; letterhead of T. A. Edison. [a]"Menlo Park, N.J.," preprinted.

1. Text is "Chalk" and "Felt."

2. Charley sketched a front view of this receiver on 26 November. On 22 November he had drawn the drum with disks partially immersed in water. His sketch of 2 December, showing blotting pad disks revolving directly in the water, was accompanied by the remark "too much water supplied." Vol. 18:95–96, 99, Lab. (*TAEM* 4:1129–30, 1132).

-1592-

From George Barker

Philadelphia, Nov. 30th 1878.[a]

My dear Edison:—

I have copied for you the enclosed statements of Dr. C. W. Siemens and of Sir. Wm. Thomson upon the economy of transmitting electrical force to a distance, as I promised. I think this is the most authoritative statement yet made in the matter and the result is of vital importance to your new Light. I hope you will find time to read it carefully.

I also enclose a slip which Farmer sent me the other day.[1] You may have received one too. His calculation at the latter end is interesting and his testimony is convincing on the question of the value of the platinum light.

I also mail you with this three papers containing the translation, by my friend Spencer Borden of Fall River,[2] of an article by the French physicist Jamin, written for the Revue des deux Mondes, upon the Electric light.[3] He gives a very good resumé of the subject, but adds nothing new. It is evident that we are in advance of Europe on electric lighting.

It seems to me that the point to which Siemens calls attention, has not received sufficient consideration; i.e., that a magneto-machine is working at a disadvantage unless the resistance of the external circuit is the same as that of the machine itself. It of course follows from this that every machine has a perfectly definite external circuit to which only it is adapted. Hence the injustice for example, in the Franklin Institute experiments, in comparing the Wallace machine with an internal resistance of 4 to 5 ohms, with the Brush machine whose resistance was only from 1 to 2, by putting the same external circuit to both, that of the Brush lamp and arc, with a resistance between one and two ohms.[b] The conditions were fair to the latter, but very unfair to the former which would have given current for four such lamps when it was working at its best, the external & internal resistances being equal. The electro-motive force of the Wallace is nearly double that of the Brush at the same speed. In your own experiments too, it is evident you will not get the best result, unless you previously calculate the resistance[b] of the lamps you are to use in one circuit & give your machine the same internal resistance. Moreover I believe that you will find great advantage in using branch circuits to effect a balance. Increasing the lamps in one circuit to increase the resistance and then putting in shunt circuits to diminish it again. Have you ever tried one of Wallace's low resistance machines on your lamp? They give exactly what you want; enormous quantity (heating power) and low resistance. That is the form of machine for you.

Be sure and go to Drapers. Come over in the afternoon and help us get ready. Mrs. B. is afraid Mrs. Edison will not like to see company as she has a young baby? Cordially yrs

Geo. F. Barker.

ENCLOSURE[c]

Discussion on Transmission of Electricity to a Distance, Inst. Civil Engineers, London, Feb. 5. 1878.[4d]

Dr. Siemens desired to add a few explanations with reference to the transmission of electric power to a distance, whether for the production of light or for the production of force. The Paper stated that the weight of the conductor would increase as the square of the distance; but that proposition although true in itself, would, if it were accepted lead to very erroneous ideas with regard to the power of transmitting force to a distance exceeding perhaps half a mile. In order to get the best effect out of a dynamo-electric machine, there should be an external resistance not exceeding the resistance of the wire in the machine. Hitherto it had been found not economical to increase the resistance of the machine to more than one ohm; otherwise there was a loss of current through the heating of the coil. If therefore there was a machine with one ohm resistance there ought to be a conductor transmitting the power either to the light or to the electromagnetic engine not exceeding one ohm. If, instead of going one mile, it was desired to go two miles, it would be necessary first of all to employ a conductor twice the length; but that conductor would give two ohms resistance and would therefore destroy much of the effect. To bring it back to one ohm resistance, it would be necessary to put down a second wire, or to double the area of the first; and in that case there would be a wire of twice the length and twice the area, therefore four times the weight and four times the cost. That pointed to an increase in the cost and in the weight of the conductor in the square ratio of the distance. But one circumstance had been lost sight of in this calculation—that, having twice the area to deal with, a second generator could be put on, and electricity enough to work two lights could be sent through the double area to a double distance. The moment that was done, the conductor was increased, for the power was transmitted only in the proportion of the increase of the length; but that was not enough. The electric conductor did not resist the motion of electricity in the same manner as a pipe resisted the flow of liquid through it; but an ohm's resistance was an ohm's resistance for a larger as well as for a smaller current flowing through it, which resistance was only increased by a rise of temperature in the conductor. This rise of temperature was kept down by dissipation of heat from the conductor; or considering that the longer and doubled conductor would possess four times the amount of surface for the dissipation of heat than the single and short conductor, it would be capable of transmitting four times the amount of electrical current. It might therefore be said that it was no dearer to transmit electromotive force to the greater than to the smaller distance, as regarded weight and cost of conductor, a result which seemed startling, but which he nevertheless ventured to put forward with considerable confidence. In uniting the two longer conductors into one, the surface would however be increased only in the ratio of $\sqrt{2}:1$; therefore the relative transmitting power between the longer and shorter conductor would strictly speaking be increased in the ratio of $1:\sqrt{2}$ or 1:2.83, and the longer conductor would be dearer than the shorter per unit of electromotive force transmitted in the proportion of 4:2.83."

Sir William Thomson said Dr. Siemens had just brought forward an idea which appeared to him to be quite new and to be of great practical importance; namely that the electric light, if there were a sufficient number of lamps, could be produced with equal economy at a great and at[e] a small distance. By way of illustration, he would suppose the cost of a central station dispensing by four hundred machines the electric current to four hundred lamps each at the distance of 1 mile. Taking those four hundred miles of wire and putting them in a line having four hundred engines in series, and putting the four hundred lamps at short distances from one another without any change of circumstances, the same effect would be produced at four hundred miles as at one mile. The question of the heat developed in the wire, was, as Dr. Siemens had remarked, the fundamental question with reference to the quantity of metal required to communicate the effect to a distance. It appeared to him that the most practical way of producing the result would be to put the wire in the shape of a copper tube. Having a copper tube with a moderate amount of copper in its sectional area and a current of water flowing through it with occasional places to let it off, and places to allow water to be admitted for the purpose of cooling; there would be without any injury to the insulation a power of carrying off heat practically unlimited. He believed that with an exceedingly moderate amount of copper it would be possible to carry the electric energy for one hundred or two hundred or one thousand electric lights to a distance of several hundred miles. The economical and engineering moral[f] of the theory appeared to be that towns henceforth would be lighted by coal burned at the pit's mouth where it was cheapest. The carriage expense of electricity was nothing, while that of coal was sometimes the greater part of its cost. The dross at the pit's mouth (which was formerly wasted) could be used for working dynamo-engines of the most economical kind; and in that way he had no doubt that the illumination of great towns would be reduced to a small fraction of its present expense. Nothing could exceed the practical importance of the fact to which attention had been called; that no addition was required to the quantity of copper to develop the electric light at a distance. The same remarks would apply to the transmission of power. Dr. Siemens had mentioned to him in conversation that the power of the Falls of Niagara might be transmitted electrically to a distance. The idea seemed as fantastic as that of the telephone or the phonograph might have seemed thirteen months ago; but what was chimerical then was an accomplished fact now. He thought it might be expected that before long towns would be illuminated at night by an electric light produced by the burning of coal at the pit's mouth, or by a distant waterfall. The power transmissible[b] by the machines was not simply sufficient for working sewing machines and turning lathes, but by putting together a sufficient number, any amount of H.P. might be developed. Taking the case of the machines required to develop one thousand H.P. he believed it would be found comparable with the cost of a thousand H.P. engine; and he need not point out the vast economy to be obtained by the use of such a fall as that of Niagara or the employment of waste coal at the pit's mouth.

ALS, NjWOE, DF (*TAEM* 17:1059). Letterhead of University of Pennsylvania. [a]"Philadelphia," and "187" preprinted. [b]Obscured overwritten letters. [c]Enclosure is D (copy) written by Barker. [d]Followed by centered horizontal line. [e]Interlined above. [f]Underlined twice.

1. The enclosure has not been found but was probably Moses Farmer's 30 October letter to the *Salem Observer* describing his early electric light experiments. The end of the letter is quoted extensively in Defendant's Exhibit Silliman's Journal Article, *Sawyer & Man v. Edison (U.S.)*, (*TAEM* 47:916).

2. Spencer Borden was a Massachusetts manufacturer, at this time probably connected with the Fall River Bleachery. He later became an agent of the Edison Company for Isolated Lighting, also in Fall River. Borden to TAE, 11 Jan. and 2 Feb. 1882, DF (*TAEM* 60:736, 853).

3. These enclosures have not been found. Jules-Célestin Jamin, a member of the Académie des Sciences and the faculty of the École Polytechnique, conducted research in optics and the construction of electromagnets. His article, "L'Éclairage Électrique," appeared in *Revue des deux mondes* 26 (1878): 280–303. *DB*, s.v. "Jamin (Jules-Célestin)."

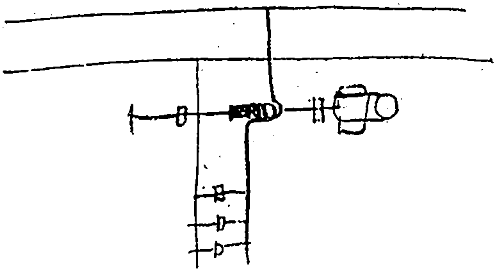
4. The 3 December *New York Herald* included the full text of this discussion in an article on "Edison's Electric Light." Edison told the *Herald's* reporter that he could divide an electric current without greatly diminishing the light it produced, despite the skepticism of scientists who considered this impossible. "I was ridiculed not long ago," Edison was quoted as saying, "for making an assertion about the transmission of power, and now I find that two of the leading scientific men of the day back up my statement." He added that he thought the opinions of Siemens and Thomson "fully as important as anything thus far said on the subject." Cat. 1241, item 1047, Batchelor (*TAEM* 94:43).

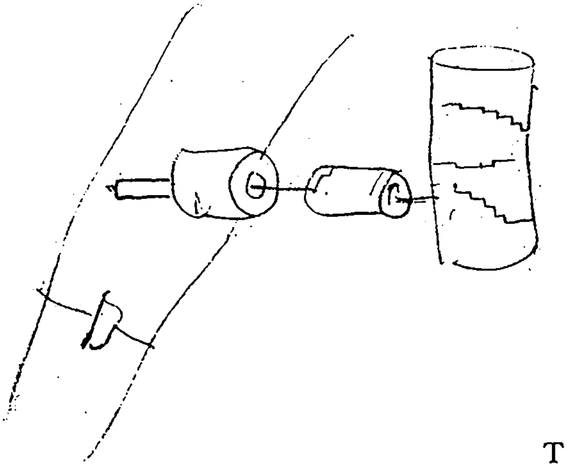
-1593-

Notebook Entry: Electric Lighting

[Menlo Park,] Nov 30 1878

Electric Light Meter[1]





T A Edison

X, NjWOE, N-78-11-28:7 (*TAEM* 29:23).

1. Though Edison remembered designing and constructing his first electric meters in October, the earliest extant drawings are from 29 November. Those drawings are even less clear than the design shown here. In this design the meter is placed in a shunt circuit with an induction coil. As the electricity is used in the lamp circuit, it flows through the shunt circut and induces a current in the induction coil, which causes the recording needle of the meter to move and record electricity usage in a fashion similar to that of a steam engine indicator. Edison's testimony, pp. 4–5, *Sprague v. Edison* (*TAEM* 46:323); N-78-11-28:9–13, Lab. (*TAEM* 29:24–26).

The 3 December *New York Herald* discussed Edison's meter experiments:

> After days of constant work Mr. Edison has at last succeeded in perfecting a suitable apparatus for measuring the quantity of electricity used. This very necessary appliance, which is to the electric light what the gas meter is to gas, has hitherto been one of the things incompleted. Before hitting upon the present device Mr. Edison had tried quite a number of others, but all seemed to lack one or another necessary element. A few days ago he branched off in a

> new direction and soon was gratified at finding that he had alighted upon just what he had so long been looking for. Constant experimenting on the new apparatus since then has proved it to be all that the inventor desired, and he has accordingly taken steps to have it patented.

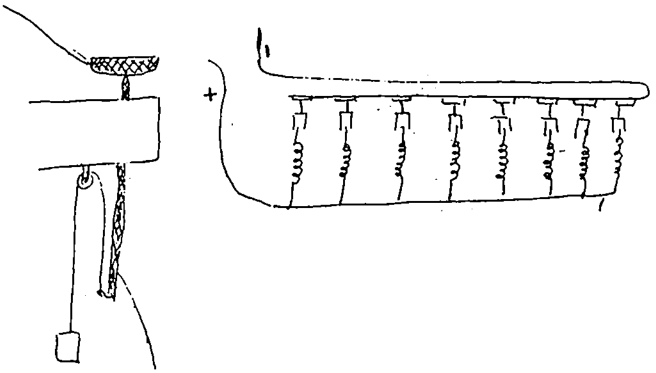
The *Herald* went on to quote Edison, "One will be placed in every house where the light is used. It registers infallibly the quantity of electricity consumed, using for the purpose one thousandth part of the quantity consumed in the house. It is a simple contrivance and comes up to all my expectations." "Edison's Electric Light," *New York Herald,* 3 Dec. 1878, Cat. 1241, item 1047, Batchelor (*TAEM* 94:131).

-1594-

Notebook Entry: Electric Lighting

[Menlo Park,] Nov 30th 1878

Electric Light[a]
Werderman's System.[1]



Worked by quantity each lamp has a resistance also to it in order to make 'difference in pressure' bugs small p[er] c[entage] of whole resist.

Average resistance of each lamp & its resistance is 0.392 ohms By this method 3 conductors are used[a]

Now if Stewarts building[2] wanted 2000 lights on this plan what sort of a conductor would you have to have to take it 1000 feet to store? By quantity if 1 Lamp was .4 ohms 1000 lamps would be .0004

The[b] wires[b] which are 3000[b] feet long would be .0004 ohms resistance Size of wire

But in this case he would no doug~~h~~bt put about 20 lamps in each cross although you have to supply when not using

X, NjWOE, Batchelor, Cat. 1304:5 (*TAEM* 91:7). Written by Charles Batchelor. [a]Followed by centered horizontal line. [b]Obscured overwritten letters.

1. On Werdermann's lamp see Doc. 1468 n. 2. On 25 November, the *New York Sun* ran an article in which they asked Edison his opinion of Werdermann's light. Edison felt that it was "a good thing. It allows more subdivision than the Joblochkoff; but the maintenance of attention and consumption of carbon cost more than the horse power used to keep it running. It doesn't allow of a reliable subdivision." He went on to explain

> you must keep fooling with the lamp all the time to keep it going. To be of utility, the subdivision must be absolutely constant. As a carbon lamp, I like it very much. But the carbon lamp won't do. I have made repeated experiments with carbon, and at one time made a lamp very similar to this one of Werdermann's. . . . It may come into use in many places, but it can never become of general use. The lamp for the people must be so simple in its construction that any fool or mule can use it. ["The New Electric Lights," Cat. 1241, item 1021, Batchelor (*TAEM* 94:416)]

2. The A. T. Stewart dry goods store, one of New York's largest, occupied the so-called "Cast-Iron Palace" on a full block of Broadway between 9th and 10th streets. Built by Alexander Stewart in 1862, the building's five floors of retail space had in recent years reportedly attracted as many as 50,000 shoppers and tourists in a single day. A *New York Sun* article on the projected costs of Edison's light stated that the store operated 3,500 gas jets at an estimated cost of $50 per night. Wolfe 1975, 164; McCabe 1970, 378–81; "The Darkness Dispelled," *New York Sun*, 14 Dec. 1878, Cat. 1241, item 1061, Batchelor (*TAEM* 94:435).

-8- December 1878

During December work in the laboratory focused on dynamo design. Edison borrowed a Gramme dynamo from Princeton and a Siemens from William Wallace to study along with the Wallace and Weston dynamos he already had at Menlo Park. Francis Upton, who joined the laboratory staff in mid-December as a mathematical and experimental assistant, worked with Batchelor and Edison on the dynamo experiments. By the end of the month, Edison had developed a new design that his machinists began building in the new machine shop.

Edison also studied other system requirements for electric lighting. During December he began designing electrolytic meters and, assisted by his new mathematician Francis Upton, he calculated the parameters for his system and made new cost comparisons between incandescent, arc, and gas lighting. To aid in these comparisons, Edison purchased additional gaslight and electrical journals.[1]

Edison left the ongoing negotiations for foreign rights to Grosvenor Lowrey, who was continuing negotiations with Drexel, Morgan & Company regarding European rights and with the New York banking firm of Mora, De Navarro & Company for Cuban rights. Because Theodore Puskas resisted giving up any rights for the Continent, Lowrey restricted his negotiations with Drexel, Morgan & Company to Great Britain. Soon after Anthony Drexel and J. P. Morgan visited the laboratory on 5 December, Lowrey drew up a draft agreement for the British rights, though it was apparently not signed until early 1879. About this time, Drexel, Morgan & Company also began to act as bankers for Edison and the Edison Electric Light Company.[2]

While the rest of his staff focused on electric lighting, Edison had his nephew Charley continued the effort to develop the electromotograph telephone receiver. As in November, Charley experimented with the chalk-wetting mechanisms and the material for the buttons. Edison apparently made a private arrangement with him regarding the development of this instrument, while urging Western Union to agree to a new contract covering it in order to provide a financial incentive for Charley's experimental work.[3] Edison was also negotiating with Western Union concerning the facsimile telegraph he was developing with Patrick Kenny, who began to work at Menlo Park at the end of the month.[4] In mid-December, Edison filed an extensive British telephone patent (No. 2396) that included designs shown in his 1878 U.S. patent applications.[5]

Uriah Painter, who along with Edward Johnson was running the Edison Speaking Phonograph Company, became concerned over Edison's toy phonograph arrangement with Hilborne Roosevelt and he asked that Edison not do anything further without consulting Painter, to which Edison agreed. Phonograph sales dropped in December. According to the company's treasurer, Charles Bailey, "The receipts during the month were . . . much reduced by advancing the price of Machines when they were selling freely." Though Bailey expected sales to increase when the prices were "put back again," he believed that several sales had been "absolutely lost by the mistaken movement." In the meantime, Edward Johnson, who was managing the company, hoped to produce a small demonstration phonograph which he planned to sell in large numbers. Johnson experimented on the instrument at Sigmund Bergmann's shop in New York, where the exhibition machines were being manufactured.[6]

During the month, George Bliss continued his efforts to deter infringers of Edison's electric-pen copying system, but became concerned by newspaper reports that Edison was developing a typewriter to replace the electric pen for use in preparing stencils. Edison explained to Bliss that James MacKenzie was working up the idea that he (Edison) had conceived some years earlier, which he had included in his basic foreign electric-pen patent. Edison did file an application for a U.S. patent on the design in December, though he did not develop a commercial instrument.

By the end of the year, Edison had decided to work "entirely at night with six of my assistants. I found that nothing could be accomplished during the day on account of the numerous visitors."[7] The six experimental assistants probably were Batchelor, Upton, Charley, Martin Force, John Knight, and chemist Henry McIntire; another twenty men were also working at Menlo Park at the year's end.[8] By this time, several of the workmen were living in Sarah Jordan's boarding house.

Reporters continued to come to Menlo Park seeking new developments and indications of when Edison would be prepared to demonstrate his light publicly. Cautioned by his patent attorney about premature reports, Edison was reserved. "I'm going to be entirely sure of myself before I attempt to put the thing in operation," he told a reporter from the *New York World.* Edison's widespread fame can be seen in Bliss's comment in a mid-December letter that "I did not find a man too remote from railway & telegraph centers to know you & who was not interested in your achievements."[9] His international reputation is reflected by the humorous drawings from a December issue of the British satirical journal *Punch,* which presented weather prediction, a form of television using telephones, and "anti-gravity under-clothing" as Edison's next marvels.[10]

1. Wilmer & Rogers News Co. to TAE, 9 Dec. 1878; undated memorandum of journals, DF (*TAEM* 17:378).

2. Drexel, Morgan & Co. receipt, 7 Dec. 1878; D-79-002, all DF (*TAEM* 17:294; 49:18).

3. The only evidence of Edison's arrangement with Charley is an account entry beginning 5 December which is headed "Chas Edison Contract." Ledger #3:335, Accts. (*TAEM* 87:146).

4. Edison remarked to a reporter that he had a man working on developing an electrical hearing aid, but there is no evidence of this work in the notebooks or timesheets. He explained that other miscellaneous inventions such as the aerophone and phonomotor were not being developed because "It takes a great deal of money to run this shop, and I must devote myself to those things that promise to pay in the near future. So you see there are many things that are to a certain extent speculative that I must drop for the time being." "Content at Menlo Park," *New York World,* 5 Dec. 1878, Cat. 1241, item 1057, Batchelor (*TAEM* 94:434).

5. The British patent covered Edison's March design for the rigid-diaphragm transmitter (Doc. 1252), but he never filed a U.S. application for this improvement. It also included a November U.S. application (Case 158) that was subsequently split into two new applications that Edison executed in September 1881 and filed the following month (U.S. Pats. 257,677, 266,021).

6. Bailey to Gardiner Hubbard, 5 Dec. 1878, ESP Lbk. 6:181–82; Bergmann & Co. bill of 7 Dec. 1878, both UHP.

7. TAE to Puskas, 3 Jan. 1879, TP.

8. The Menlo Park staff also included experimenter Patrick Kenny, nine machinists (Charles Dean, Charles Flammer, Rudolph Hense,

John Hood, George Jackson, John Kruesi, Thomas Logan, Charles Moffat, and John Ott), two carpenters (Milo Andrus and Alex Campbell), George Carman and John Randolph, who helped out around both the laboratory and office, bookkeeper William Carman, secretary Stockton Griffin, Joseph Knight, who made carbon buttons, and Alfred Swanson, who became the night watchman after having spent the previous two years assisting in the laboratory and shop. A. J. Roxbury, who had been hired at the end of November to assist with the painting of the machine shop, became a shop assistant in mid-December, at which time steam engineer William Taws left Menlo Park. Edward Mack began working as a general handyman at the end of the month. Timesheets, DF (*TAEM* 17:825–76).

9. "Content at Menlo Park," *New York World,* 5 Dec. 1878, Cat. 1241, item 1057, Batchelor (*TAEM* 94:434); Doc. 1624.

10. "Punch's Almanack for 1879," *Punch,* 8 Dec. 1878, Cat. 1241, items 994–98, Batchelor (*TAEM* 94:445–47).

-1595-

From Grosvenor Lowrey

New York, Dec 2nd 1878[a]

My dear Edison:

I understand Mr Belmont expects to go out on Wednesday if that will suit you but I will ascertain definitely today and let you know this afternoon.[1]

Mr. Fabbri informs me that Milton Latham, president of the London & San Francisco Bank,[2] and an intimate friend of Drexel Morgan & Co., landed on these shores a short time since the owner of the Gramme (& Jablochkoff's[b]) patents for the United States and with eight or ten Gramme Machines and an expert person to set them up. He‸learned with "igstreme" disgust of your light and decided not even to take the machines out of the Custom House until you should be further heard from.

He has left for California but I yesterday asked Mr Fabbri if he could not get you one of[c] the machines for use at Menlo Park. If you desire it please let me know and I have no doubt it can be managed. In the meantime I am going to look up Mr Hazard[3] who applied to me some time since and claimed then to have the power to dispose of the Gramme patent for this country. Very truly yours

G. P. Lowrey

P. S. Mr Drexel,[4] with two or three friends from Philadelphia, and the parties from New York will visit you on Monday next.[5]

LS, NjWOE, DF (*TAEM* 18:95). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. Written by Rockwell

Kent. [a]"New York," and "187" preprinted. [b]"'s" interlined above. [c]Repeated at end of one page and beginning of next.

1. In a telegraph exchange later in the day, Lowrey and Edison agreed on Friday, 6 December, as the date for the visit (DF [*TAEM* 18:98]). On 29 November, Rockwell Kent, Lowrey's secretary, had written Edison about Lowrey's "very pleasant conversation" with August Belmont during which Belmont had asked to meet Edison and said "that he desired to gain for you the benefit of the influence and support of his friends in Austria." Kent told Edison that Lowrey thought "it very desirable that the meeting should take place and hopes that you will certainly come in town" (DF [*TAEM* 18:204]). Later on the 29th Lowrey attempted to arrange a meeting for the following day in New York, but he subsequently agreed to bring Belmont out to Menlo Park in order to accommodate Edison (telegrams between Lowrey and TAE, 29 Nov. 1878, DF [*TAEM* 18:93–94]).

2. Milton Latham served one term in the U.S. House of Representatives and was elected governor of California in 1859. Immediately after his inauguaration he was appointed to fill an open seat in the U.S. Senate, where he became noted for his Southern sympathies. Latham amassed a fortune in railroading and as president of the London and San Francisco Bank from 1865 to 1878 but lost it in railroad investments before his death in 1882. George Bliss wrote Edison on this day that Latham had stopped in Chicago on the way from Paris to San Francisco. *DAB*, s.v. "Latham, Milton Slocum"; *NCAB* 4:108; Bliss to TAE, 2 Dec. 1878, DF (*TAEM* 18:356).

3. Rowland Hazard was a New York investor who in the 1880s became president of the Gramme Electrical Co., the American Electrical Manufacturing Co., and an electric railway in Cleveland. In 1884 he was elected treasurer of the new American Institute of Electrical Engineers. Passer 1972, 39, 225; *Transactions of the American Institute of Electrical Engineers*, 1:4.

4. Anthony Drexel (b. 1826) was the dominant partner in the Philadelphia banking firm of Drexel & Co., founded by his father in 1837. *NCAB* 2:273; Carosso 1987, 133–45.

5. That is, 9 December. A visit to Menlo Park by J. P. Morgan, Egisto Fabbri, and Anthony Drexel had been planned for the day of this letter, but Lowrey had to postpone the trip "on account of previous engagement with Drexel." Lowrey to TAE, 30 Nov. 1878, DF (*TAEM* 18:210).

-1596-

To Theodore Puskas

Menlo Park, N.J., Dec 3d 1878[1a]

Puskas

Important negotiations with Drexel Morgan here. May require considerable more money to develope light. If I can secure you re-imbursement of outlay and ten per cent net profits whole thing to be financed by Drexel and their connections you to co-operate will that be satisfactory Think our interests will be greatly advanced—Answer important[2]

~~Thom~~ Edison

LS (telegram), NjWOE, DF (*TAEM* 18:211). Letterhead of T. A. Edison. Written by Stockton Griffin. [a]"Menlo Park, N.J.," and "187" preprinted.

1. At the bottom of this cable Griffin noted that it "cost $43.32 gold & will be paid by DM & Co." Edison sent this message instead of one that Grosvenor Lowrey drafted with Fabbri and Morgan and mailed to Edison on 30 November. That message read:

> Think I can negotiate much better here and secure one strong combination to finance light and sell it. I must be entirely free however. If you leave it to me will secure for you such share in general profits as I think right under circumstances besides reimbursement your outlays and compensation for any future services My interest requires this and practical success may depend on it. Answer

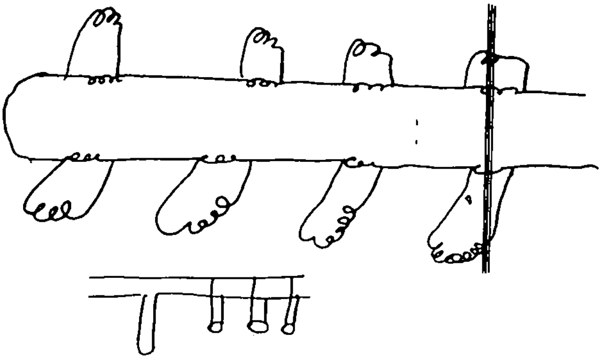
Later on 30 November, Lowrey wired Edison not to cable Puskas until he had shown the message to Drexel, Morgan & Co. DF (*TAEM* 18:207–10).

2. Puskas wired back on 5 December, "Answer tomorrow" (see Doc. 1606). DF (*TAEM* 18:221).

-1597-

Technical Note: Electric Lighting

[Menlo Park,] Dec 3, 1878



Lights[1]	Res[istance]
1.[a]	100
2	50
4	25
8	12½
16	6.12
32	3.06
64	1.53
128	.76
256	.38
512	.19
1000	9.

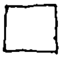
if I use 3 lights of 100 ohms each in each branch then I use 3000 lights & increase the intensity

Res[b] of ¼[inch] wire 25~~f~~00 feet[c] ½ ohm[2]

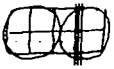
189.[3]
2
3~~6~~78.
94
472. lbs for 25 feet[4] — ¼ inch.[c] or ½ ohm or 0.5
4
1888 — ½ inch — 0.12[d]
4
7552. — 1 inch .03.
4
30,208 lbs only ½ of ckt.[e]— 2 in .033.
2
60,416
20
12,083.20

600 1 inch[5]
25,000.
250 000.

15 000
20
3000.00



inch surface



[a] 1⅛ × ⅜ 2½ ~~1~~inch ⅛
⅜ by ¾

12)2000(166
12
80
72
80
~~8~~72 8
166.
2 feet wide 83 feet long.

total res. .~~27~~18 hundredths of an ohm.[6]

TAE
M N Force

Chas Batchelor
J. Kruesi
Wm Carman

X, NjWOE, Lab., Vol. 16:309 (*TAEM* 4:744). Miscellaneous rough calculations have not been transcribed. [a]Written next to canceled number. [b]This line and following calculations added at left of preceding table in original. [c]"100." written above. [d]Obscured overwritten letters. [e]"only . . . ckt." interlined above.

1. Although the precise significance of the calculations and sketches in this document is uncertain, they concern characteristics of electric lighting systems with large numbers of lights spread over a considerable area.

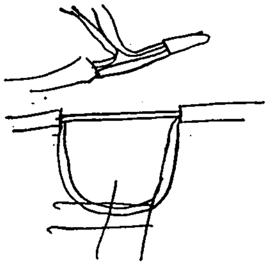
2. This evidently refers to copper wire; contemporary references gave the resistance of 1 mile (5280 ft./1609.31 meters) of pure copper wire with a diameter of .22 inch (5.59 mm) as 1.1278 ohm. Adjusting for an increased diameter and half the length yields approximately the figure given here. Prescott 1877, 967; cf. Clark and Sabine 1871, 109.

3. This is the weight in pounds (equal to 85.7 kg) of 1,000 feet (305 m) of pure copper wire with a diameter of .25 inches (6.35 mm) (calculated by the editors from figures in Prescott 1877, 967; there is a similar table in "Directions for Setting up and Operating the Brush Dynamo-Electric Machine, for Electric Light," DF [*TAEM* 17:1101]). Edison multiplies it by 2 (378) and then adds half again (94) to get the figure for 2,500 feet (approximately half a mile). He quadruples that figure three times to calculate the result of doubling the diameter successively to ½, 1, and 2 inches, and then doubles that number to get a rough figure for the weight of a mile of 2-inch copper wire (60,416 pounds). Finally he multiplies that by $0.20, the approximate price of a pound of copper (*Ency. Brit. Supp.*, s.v. "Copper"), to get the cost for that mile of wire ($12,083.20).

4. I.e., 2,500 feet.

5. The figures below are a rough estimate of the price of a mile of 1-inch copper wire, using 7,500 pounds per half mile and $0.20 per pound (see note 3).

6. There are four other similar sheets from this day covered with related rough sketches, tables, and calculations. They show many variations on parallel, series, and combined circuits, switching arrangements, a few lamp designs, and some detail about junctions at branching points in circuits. Vol. 16:307, 310–11; Cat. 1146; both Lab. (*TAEM* 4:743, 745–46; 6:637).

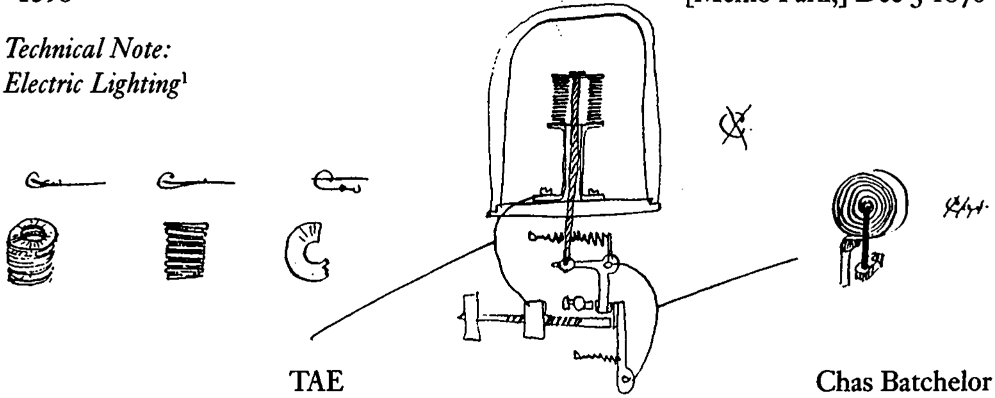


Details from sketches of 3 December showing plans for wiring junctions in electric power distribution systems.

-1598-

[Menlo Park,] Dec 3 1878[2]

Technical Note: Electric Lighting[1]

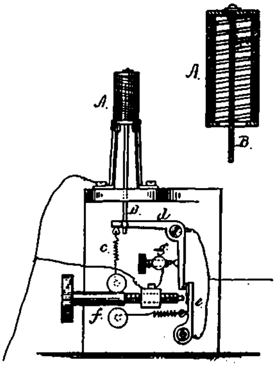


TAE
M N Force

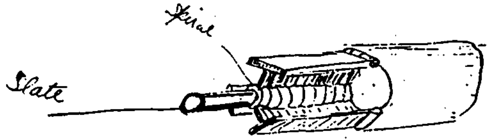
Chas Batchelor
J. Kruesi
Wm Carman

X, NjWOE, Lab., Vol. 16:311 (*TAEM* 4:746).

1. The lamp drawing below shows the design principles that Edison claimed in a patent application executed on 9 December (Case No. 166) which was allowed in 1880 but subsequently abandoned (Patent Application Casebook E-2536, PS [*TAEM* 45:698]). Only the drawings and claims from that application are extant, but a full description is included in his British Patent 5,306 (1878), for which Edison executed the provisional specification on 28 December. Here Edison claimed that by using a "pyroinsulating coating" he could wind several layers "of very fine wire" in his lamp so that each burner would "have a resistance of several hundred ohms which permits of several hundred burners or lamps being connected quantitively in multiple arc, without requiring large main conductors." This coating was "an oxide of metal, such as cerium, lime, magnesia, or other metal or material which will not be injured by a high degree of heat." In his British patent, Edison described a method and device (fig. 5) for applying the pyroinsulation "by dissolving the oxide in an acid, coating the wire or strip with the solution, and then passing the wire or strip through heat from a flame or otherwise," which decomposed the solution and deposited the oxide. The pyroinsulation made it more difficult for the metal wire or strip to fuse and prevented the current from passing between the metal coils after they were wound around "a spool or cylinder of lime or other infusible material." Edison also suggested using the pyroinsulating material as a layer between the coils.

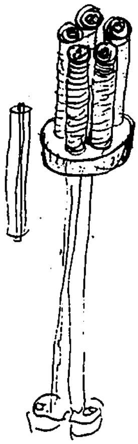


Drawings from Edison's U.S. patent application for electric lights with coiled coated wire burners.



Charles Batchelor's 4 December drawing of a mechanism to fill spiral burners.

2. In the following days, Batchelor sketched a "Machine for filling spirals with chalk or other insulator" and included directions for its construction and use (it was made by George Jackson) as well as an "Instrument for pressing spirals under heat." The lamp design shown in Edison's American and British patent applications (see note 1) also incorporated a new electromechanical regulator developed during December; on 5 December, Batchelor drew details of the center rod and the "Mode of fastening the ends of spiral into end pieces" for that regulator. He and Edison also sketched several variations of this lamp design through the middle of December. They considered pneumatic regulators as well lamps consisting of multiple bobbins; Edison included the latter in British Patent 5,306 (1878, fig. 3). At the end of the month, after extensive experiments with pyroinsulators, Edison listed the advantages of "coating wire with a non conductor of heat" as "solidity strength & capability of long service, cheapness, non liability to derangement, noiseless [and] compactness." Vol. 16:307, 314, 319; N-78-11-22:5–7; N-78-12-04.2:1–13, 17–25; N-78-12-11:3; N-78-12-15.1:1; N-78-12-15.2:19; all Lab. (*TAEM* 4:743, 747, 751; 29:155–56, 328–34, 336–40, 680, 942; 40:314).



11 December sketch by Edison of a multiple bobbin lamp.

-1599-

To Clarence Blake

Menlo Park, N.J., Dec 4 1878[a]

My Dear Dr Blake

Your favor of the 22d ult was duly rec'd. You must not suppose for a moment when you do not get prompt replies to your letters, that it is because I do not like to hear from you.[1] I think there is no doubt I am the busiest man in America. This everlasting entertaining people from all over the world and from the farms hereabouts is fearful trying and murders ones time frightfully.

My health is first class now and when opportunity offers I am head & heels over in laboratory work The phonograph gets little consideration from me nowadays, although when I get in my new building there will be two men put on it and I hope to bring out something entirely new in that line.[2]

Much obliged for the reprint which you sent.

I expect to have the new works in operation inside of ten days. Very Truly

T. A. Edison G[riffin]

L, MB CJB. Letterhead of T. A. Edison. Written by Stockton Griffin. [a]"Menlo Park, N.J.," and "187" preprinted.

1. Blake had enclosed in this letter a reprint of his paper on the telephone which had been read in London. He explained to Edison "that I close the lecture with a tribute to Bell in which I think you will agree with me as I do with you in your remark that there are but two telephones, Edisons and Bells. As the experiments were made entirely to measure the excursions of the discs of the Bell telephone I had no occasion to refer to your experiments." He also said he hoped to make more phonographic experiments with human ear membranes. Blake's paper has not been found. Blake to TAE, 22 Nov. 1878, DF (*TAEM* 16:468).

2. On 28 November, Blake had sent Edison part of a draft paper on the "Graphic and Photographic illustration of Sound waves." He asked for additional information from Edison or Batchelor about the phonograph's invention and "the train of thought or of experiment which led to the use of the present recording tin foil." A docket notation on Blake's letter indicates that Batchelor replied on 30 November (DF [*TAEM* 18:1063]). Blake's draft attributed the invention to Edison's electric pen experiments on indenting a yielding surface. The version published in the first number of the *American Journal of Otology* ascribed it to work on embossing telegraphs, in which Edison thought of "substituting for the magnet and lever a diaphragm and point, and thus reproducing speech; but at the time the due importance was not attached to the conception, from the supposition that the rapidity of the vibrations of the disk would not allow the needle-point to drop into the indentations with sufficient accuracy" (Blake 1879, 6). In February 1879 Blake sent a copy of the issue containing this article to Edison, who subsequently

subscribed to the journal. Blake to TAE, 28 Nov. 1878, 14 and 18 Feb. 1879, DF (*TAEM* 18:1063; 49:769, 774).

-1600-

Telegrams: From/To D. V. Lynch

December 4, 1878[a]
N.Y. 5:20 PM

T. A. Edison

Did you see J. H. Russells objection to your patent in England. Tell me who he is and what it means. space no object.[1]

D. V. Lynch[2] The World

Menlo Park, N.J.,[b] 8:35 PM

D. V. Lynch,

Do not know him or anything about it. I suppose he takes advantage of some technical flaw. They have a beautiful system of patent law invented I think by King Canute or some other ancient ruler ~~that~~ who understood the needs our times.[3]

Edison

L (telegrams), NjWOE, DF (*TAEM* 18:830). [a]Date from document, form altered. [b]"Menlo Park, N.J." preprinted on letterhead of T. A. Edison.

1. The previous day, John Huddart Russell had lodged a protest against one of Edison's British provisional patents, claiming that Edison was "not the true and first Inventor of the said Improvements or of some of them." The provisional specification, which had been filed on 23 October and subsequently issued as British Patent 4,226 (1878), was for an electric light system including a tuning fork generator, central station regulator, self-regulating spiral lamps, and current meters. The London firm of Brewer and Jensen defended Edison's application and subsequently reported to Lemuel Serrell that Russell had no invention of his own. Russell had apparently acted on behalf of A. Arnaud, whose British Patent 4,074 (1878)—for a system of electric lighting in which the lamps were placed in parallel circuits—had been filed in October. That patent was still unsealed and could therefore have been opposed by Edison (Brewer and Jensen to Serrell, 17 Dec. 1878, DF [*TAEM* 18:851]; Dredge 1882–85, 2:lii). A copy of Russell's statement, made by Brewer and Jensen and sent to Lemuel Serrell on 4 December, is in DF (*TAEM* 18:828); an excerpt was also published in the 19 December *New York Sun.* "The Genie of Menlo Park," Cat. 1241, item 1066, Batchelor (*TAEM* 94:436).

2. D. V. Lynch worked for the *New York World,* probably as a reporter. He had corresponded with Edison earlier in the year about possible stories for his paper. *TAEM-G1,* s.v. "Lynch, D. V."

3. The *New York World* quoted the last two sentences of this telegram

in a 5 December story about Edison's electric light research. On the morning of 4 December, after learning of Russell's objection, Edison had wired Serrell for clarification: "Can patent be opposed after obtaining great seal." Serrell answered that it could not. Edison telegraphed back at 8 PM that he understood the patent was "ordered to be sealed immediately How is that." "Content at Menlo Park," Cat. 1241, item 1057, Batchelor (*TAEM* 94:434); TAE to Serrell and Serrell to TAE, both 4 Dec. 1878, DF (*TAEM* 18:829).

Serrell replied the next morning that "Notices to Seal have to be published three weeks to allow opposition to be entered." He explained the situation more fully in a 6 December letter. The patent had been filed in October

> and notice to proceed was given as soon as the same could be done, viz Nov. 12. when the certificate of Prov. prot. was delivered.— Opposition could be entered as the law provides before the expiration of three weeks viz before Decr. 3d. The case comes up before the "Law Officer," and he hears and determines the question whether Edisons provisional has been obtained "in fraud of the true and first inventor": That is the only allowable opposition: The opposition has to show that Russell was the first inventor of that which Edison has shown, and this opposition is made in ignorance of what Edisons spec. contains; The published title does not give any idea of the nature of your invention, hence Russell may claim some different device and will have his trouble for nothing, and have to pay the costs.

Serrell wired Edison on 20 December, "Brewer Telegraphs Russells objection defeated with costs." Brewer and Jensen to Serrell, 4 Dec. 1878; Serrell to TAE, 5, 6 and 20 Dec. 1878; all DF (*TAEM* 18:825, 831, 833, 855).

-1601-

From William Siemens

London, S.W. 4th December 1878[a]

Dear Sir,

I received your telegram this morning as follows "Better patent your magneto here immediately"[1] I thank you for the hint and beg to say that it has been my intention to do so before but all the necessary papers have not yet been prepared.[2]

I am, Dear Sir, Yours very truly[b]

C William Siemens

LS, NjWOE, DF (*TAEM* 17:1071). Letterhead of Siemens Bros. [a]"London, S.W." and "18" preprinted. [b]"Yours very truly" written by Siemens.

1. This is the complete text of Edison's 3 December cable to Siemens. DF (*TAEM* 17:1070).

2. Siemens's British Patent 3,134 (1878) covered a pattern of winding two separate wires around each armature coil. With one end of each

pair connected through a metal ring on the armature and the other ends placed at opposite sides of the commutator, the wires acted as a single circuit. Because this design increased the length of wire passing through the magnetic field with each revolution, the Siemens dynamo could produce more electricity per horsepower and weight than other machines. In early models the routing of wires to the commutator was asymmetric and complex, although simpler arrangements were adopted later. Edison recalled that "Upton, Batch, & myself worked three days & nights on Siemens' patent to figure out how the devil he connected up his armature & we never succeeded in doing it from the patent." Siemens does not appear to have received a U.S. patent for this design. Dredge 1882–85, 1:56, 77, 279–84, 2:xlvii; King 1962c, 393; TAE to Edward Johnson, 23 Nov. 1881, Lbk. 9:331 (*TAEM* 81:111).

-1602-

From George Gouraud

London, 5 Dec 1878[a]

T. A. Edison Esq.

Referring to Preece's remarks concerning your "Only[b] 3[c] useful inventions" as given in extract from to-days Standard herewith[1] perhaps you will like to give me full data from which this apparently slanderous statement may be contradicted. If you do I will see that it is done in a handsome form. Send me a complete list of the "269 patents."[2] The statement left unanswered is calculated to lead to very prejudicial inferences and we may make such an answer to this as will effectually show Mr Preece's animus, and have incidentally some important bearing upon the microphone controversy.

GEG

LS, NjWOE, DF (*TAEM* 18:213). Written by John Kingsbury. Note form of George Gouraud; note form is electric pen copy. [a]"London," and "1878" preprinted. [b]Interlined above. [c]Underlined twice.

[1] Gouraud enclosed a clipping from the 5 December *London Standard* concerning the paper "On the Practical Application of Electricity to Lighting Purposes" read by James Schoolred before the Society of Arts. In the discussion that followed Schoolred's paper, William Preece stated that he "did not believe" it would be possible to achieve a practical subdivision of the electric light as "the intensity of the light diminished according to the square of the number of lights into which it was divided." He went on to call Edison "'an American of the Americans,' who had taken out 269 patents, of which only three were being worked, so far as he knew. He believed that although Mr. Edison was a clever inventor he had in this instance 'stumbled on a tremendous mare's nest.'" DF (*TAEM* 18:214).

[2] Edison had been issued 133 U.S. patents at this time, as well as a small number in other countries. Among the devices then being used commercially that incorporated at least one Edison patent were printing telegraphs, quadruplex and district telegraph systems, telephone

transmitters, the phonograph, and the electric pen. Any reply Edison made to Gouraud about Preece's comments has not been found.

-1603-

From Grosvenor Lowrey

New York, Decr 5th 1878[a]

My Dear Edison:

Mr Banker and myself have observed that you have only drawn about $1250 of the money which was set apart to repay your former disbursements,[1] and I explained to the Executive Committee this afternoon that, considering the difficulty there is in keeping your accounts, it is not unlikely that you are unable now to trace the $3000 which we understood had been disbursed and that that was perhaps the reason why you did not draw it. It was generally agreed that whether that was so or not you are entitled to draw that amount; and since the Company observed that you are devoting your time exclusively now to the light and thus cutting yourself off from sources of income which might be otherwise[b] open to you, they wish to add to your weekly bill $75, just the same as if they were paying you a salary to that amount.

This was agreed upon as a convenient way of putting you in funds for personal uses while still leaving the fund in bulk and ready for use in experimenting if required, which I understood was your particular desire. Truly Yours

G. P. Lowrey per Griffiths[2]

L, NjWOE, DF (*TAEM* 18:101). Written by Griffiths; letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted. [b]Obscured overwritten letter.

[1] See Doc. 1494 nn. 4 and 5.

[2] Unidentified, probably a clerk or secretary at Porter, Lowrey, Soren & Stone.

-1604-

Grosvenor Lowrey to Stockton Griffin

New York, Decr. 5th. 1878[a]

My Dear Griffin:

The $250 which I deposited was for the $245 which you will remember I treated as a loan to Edison in the first place, and added to one of his bills and retained it myself.[1] At that time we had not had so much talk about foreign matters and I did not know precisely how they were to be fixed and the thing had rather passed from my mind; but on my way home the other night it suddenly occurred to me that there was some money which ought to be restored to him, and I thought I would do it in this way.

I do not think any other fees have been paid, although I authorized Mr Serrell to send the bills to me.

Nothing comes out from the Electric light fund for the foreign patents. D.M & Co are far enough into this matter now to be quite willing, I am sure, to advance all the cash required for those purposes.

The Drexel & Company partnership paper has not been signed, but I will try and have it prepared within a day or two.[2]

Messrs. Navarro, Mora[3] & Gallaway[4] must be brought out at some time, and I propose, since it is awkward to mix them with Belmont, that I go down with them tomorrow at Eleven, arranging with Mr Belmont to go down by the 2 o'c train so that he will arrive just as they will be leaving by the 3 o'c train.

I realize the annoyance of all this, but this end of the line has to be managed in that way. Navarro and Mora are very enthusiastic friends and supporters, and their Cuban business I look to as very important. I have put them off once or twice, telling them that we thus take up time which is of great value, but I do not like to repeat this too often. Edison must therefore allow this to be added to the interruptions, and after next Mondays visit I believe everybody will have seen what is to be seen, and he will then be left free to pursue his studies without further interruption, and strongly supported by the sympathy & confidence of his friends & associates. Yours truly

G. P. Lowrey

The following despatch has just been received from J. S. Morgan & Co in answer to a message sent yesterday enquiring about your order for chemicals.[5] Shall we telegraph to have those sent immediately which are ready? "Bulk chemicals ready. Highly alloyed wire perhaps impossible. Promise persevere." J.S.M & Co

I enclose a slip from last nights "Commercial Advertizer"[6] L.[b]

LS, NjWOE, DF (*TAEM* 18:219). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted. [b]Followed by centered horizontal line.

1. See Doc. 1494 n. 5. Lowrey had wired Edison on 4 December: "Have placed two hundred and fifty dollars to your credit with Drexel as return of British patent fees." Griffin replied that Edison wanted to know "if the fees for the two British patents which have been sent over and for the one now ready to be sent are taken from the E Light fund and if so cannot the total amount be placed to his credit." Lowrey to

TAE, 4 Dec. 1878, DF (*TAEM* 18:100); Griffin to Lowrey, 4 Dec. 1878, Lbk. 4:28 (*TAEM* 80:21).

2. In his 4 December letter, Griffin wrote that Edison "requests me to ask if he has signed the Drexel Co partnership as he has no recollection of so doing."

3. Probably Joseph Mora (b. 1844), a Cuban exile who became a Wall Street banker. He was likely José De Navarro's partner in the New York banking firm of Mora, De Navarro & Co. Obituary, *New York Times,* 14 Dec. 1904, 9; *NCAB* 15:246.

4. Robert Gallaway was a New York banker and associate of J. P. Morgan. He was an original investor in the Edison Electric Light Co. Obituary, *New York Times,* 14 Nov. 1917, 15; Articles of Incorporation, DF (*TAEM* 18:38).

5. On 5 November, Edison had sent an order to Johnson, Matthey & Co., a London firm that refined precious metals and manufactured various platinum devices. James Adams had contacted them in October and was advised that "Iridium in a state of purity cannot be supplied in the form of sheets and wires, as it is not malleable or ductile—but we make high alloys of platinum and Iridium in sheet and wire which may answer your purpose." Johnson, Matthey & Co. to TAE, 7 Feb. 1879, DF (*TAEM* 50:21); Johnson, Matthey & Co. to Adams, 22 Oct. 1878, and Johnson, Matthey & Co.'s Paris Universal Exposition circular, both Cat. 30,102, Scraps. (*TAEM* 27:950–52); information from other chemical and metallurgical companies follows in Cat. 30,102; draft orders for this material are in DF (*TAEM* 18:510–12).

On 5 December, Johnson, Matthey & Co. responded to J. S. Morgan & Co.'s inquiry by explaining that "the highly alloyed iridium wires are causing us much trouble; the difficulty in preparing some of them being we fear insuperable." Johnson, Matthey & Co. promised to keep trying and, "as Mr Edison seems to be pressing you, we will at once pack and send forward all the items of the order that are now ready and which form the bulk of it." A copy of this letter was sent to Edison by Drexel, Morgan & Co. on 18 December. Johnson, Matthey & Co. to J. S. Morgan & Co., 5 Dec. 1878; Drexel, Morgan & Co. to TAE, 18 Dec. 1878; both DF (*TAEM* 17:1091, 1093).

Edison wired Lowrey on 6 December, "Please have J.S.M & Co send forward at once material that is ready." The first shipment of material did not reach New York until about 18 December, the day that Drexel, Morgan & Co. wrote Edison that they had received Johnson, Matthey & Co.'s invoice. A second parcel, containing platinum alloy foil and wires, arrived on 23 December. Johnson, Matthey & Co. supplied most of the items remaining from Edison's 5 November order in early 1879. TAE to Lowrey, 6 Dec. 1878; Drexel, Morgan & Co. to TAE, 18 and 26 Dec. 1878; Baldwin Bros. & Co. to TAE, 23 Dec. 1878; Johnson, Matthey & Co. invoice, 12 Dec. 1878; Johnson, Matthey & Co. to TAE, 4 Jan. and 7 Feb. 1879; all DF (*TAEM* 17:1073, 1091, 1111–12, 1116, 1117; 50:6, 21).

6. Not found.

-1605-

From Grosvenor Lowrey

N.Y. Dec 6 1878[a]

T A Edison

Navarro and Mora go by Eleven oclock train. I am detained by a Western Union case. Expect to come by two or three oclock train with Belmont.[1] I should frankly explain to visitors that you are not in condition to show much but will let them see what you have at present and they must make allowances and they must make allowances and await better exhibition when you get chemicals from England and better facilities.[2] D.M & Co have ninety five hundred dollars for you will bring papers[3]

G. P. Lowrey

L (telegram), NjWOE, DF (*TAEM* 18:102). On letterhead of T. A. Edison; written by Stockton Griffin. [a]"187" preprinted.

1. Lowrey sent this telegram at 11:35 A.M., having telegraphed the previous day that "Mr Navarro and I will come down at eleven and Mr B will arrive about three." At 11:55 he wired that neither Navarro nor Mora would visit that day, but telegraphed again at 12:45 to tell Edison that he and Belmont would arrive on the three o'clock train. DF (*TAEM* 18:102–3).

2. On Thursday, 5 December, Batchelor had drawn up a list of items "To be made immediately & shown on Friday afternoon—"

> 2 old style lamps double spiral square
> 1 Lamp (long spiral) about ~~10~~ 6 springs
> 2 Lamps new pattern
> Get some platina wire pure for springs—

N-78-11-22:3, Lab. (*TAEM* 29:154).

3. Lowrey is apparently referring to a draft of the agreement between Edison and Drexel, Morgan & Co. (Doc. 1649). A draft with alterations, including one initialed by Lowrey and dated 6 December, is in DF (*TAEM* 18:238).

-1606-

From Theodore Puskas

Paris, 5:35 P.M. Dec 6—78

Edison

Original conditions of our agreement being maintained Can do better for both of us with parties here having more European influence than yours whose support was secured before your recent cables

Cable amount required for development light if figures not too high can arrange cable payment immediately secured on my interest leaving yours untouched

Puskas

L (telegram), NjWOE, DF (*TAEM* 18:221).

-1607-

Grosvenor Lowrey to Egisto Fabbri

New York, Dec. 6th, 1878[a]

My dear Fabbri:

Edison has been in daily expectation of the wire and chemicals which were ordered in London through you more than a month ago, and when you mentioned last night that Mr. Drexel intended to bring with him a gas expert, I thought at once it was doubtful whether he could be prepared to exhibit a light on Monday such as ought to be shown for the first time to critical persons.

I think it very desirable that Mr. Drexel, Mr. Morgan and yourself should see the thing in its present state, not because you can now see what Mr. Edison, as I understand him, expects his light to be when he has suitable power from his new engine and the various essential requisites included in the London order for chemicals. But you will more rightly appreciate what he is doing, by seeing the light in what I may call its formative state. ~~u~~Until the new building is done and the new engine is running and he has all the facilities which he says the matter requires, it would not be fair to him nor to any expert to visit him. But I repeat, I think the members of your firm ought to go now.

I am on my way to Menlo Park to-day and will let you know tomorrow what Mr. Edison says about this communication. Very truly,

[G. P. Lowrey]

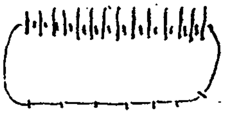
TL (copy), NjWOE, DF (*TAEM* 18:106). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted.

-1608-

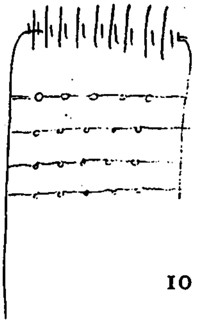
Technical Note: Electric Lighting

[Menlo Park, c. December 7, 1878][1]

100 cells 100 ohm



100–1 ohm lamps.



10 lamp in 10 series.

1	1000
2	500
4	250
8	125
10	10 000
20	5000
40	2500
80	1250

1	10 000
2	5000
4	2500
8	1250
16	625
32	312½
64	156¼

If you have 100 lamp each of 1 inch radiating surface and each of a resistance of 1 ohm all connected in series and to a battery which will keep them incandescent then you can make 100 lamps of 100 1000 or 10 000 ohms resistance arranging them so the ~~res~~ combined resistance of the whole equals that of the 100 1 ohm lamps in series and the result will be the same but for general lighting the high resistance lamp[a] will be the best not because it is more economical but because It is impracticable to work in series and all lamps given to consumers must be in multiple arc hence at a mile distant 1 one ohm lamp would require a conductor having a resistance not over 0.2 of an ohm whereas a 10 000 lamp might have at conductor of .1 10 50 or even 100 ohms without materially weakening the ~~cir~~ incandescence.

X, NjWOE, Lab., N-78-12-15.2:9 (*TAEM* 40:309). Miscellaneous rough calculations have not been transcribed. [a]Interlined above.

1. Edison probably wrote this entry between 29 November, when he made related notes in a different notebook, and 15 December, when he dated subsequent material in this notebook. He made a similar table of lamp resistances on 3 December (Doc. 1597). Following this entry are two undated pages with similar tables indicating the resistance of circuits with a given number of lamps. N-78-11-28:13; N-78-12-15.2:15–19; both Lab. (*TAEM* 29:26, 40:312–14).

-1609-

From Edward Johnson

NEW YORK DEC 9 [1878][a]

Am short of Phono's—if not using the large Brass one please return— Am making you a handsome one for Xmas. 6 sold so far this month—trade good yet.[1] Sorry didn't see you Saturday—will be out some day this week with your traps & the fine Phono.[2]

Johnson

ALS, NjWOE, DF (*TAEM* 19:159). [a]Place and date from postmark.

1. The Edison Speaking Phonograph Co. subsequently reported December sales of fifteen machines, five more than the previous month (see Doc. 1484 n. 1). Edison Speaking Phonograph Co. royalty statement for December 1878, DF (*TAEM* 19:204).

2. In January, Johnson recalled "the fine Brass Phono" he had given Edison. He explained that "In the fine Phonographs we introduced a new feature viz: using Tubeing for Cylinders—net result—'Magnificent failure.' they all warp in at the slots—& cause the needle to skip ½ inch or more at the slot. We will have to replace Cylinders with the Old Style solid Brass." Johnson asked that if Edison had received one of the hollow cylinders, he return it "at once to be altered at same time as others." It is unclear how many brass instruments had actually been sold by this time. The only brass machine listed on the royalty reports was sold in November. Johnson to TAE, 18 Jan. 1879; Edison Speaking Phonograph Co. royalty statements for November 1878; both DF (*TAEM* 51:681; 19:201).

-1610-

Francis Upton to Charles Batchelor

New York, Dec. 9. 1878

Dear Sir:

If present prospects as to work are fulfilled I shall be ready to go and make my home with you. I have a list of references to books not in the Astor Library.[1] If Mr. Edison wishes I should be happy to go to Boston to search for them. I do not think they are referances of vital importance, yet they would make my search more complete. The Berlin summary of Progress in Physics ~~such~~[a] since 1857[2] is one, and an index to Poggendorff's Annalen[3] is another.

Will you be so kind as to ask him for me and also to tell me what arrangement I can make for finding a place to lay my head, and a table to allay my appetite.

I am still in doubt as to the question we were discussing, and am growing weak-kneed in the support of my side.[4] Yours most Truly

Francis R. Upton

⟨Edison dont want you to go to Boston at present ~~so~~ you can come up ~~at present~~ as soon ~~as conv~~⟩[5b]

ALS, NjWOE, DF (*TAEM* 18:108). [a]Obscured overwritten letters. [b]Marginalia written by Charles Batchelor.

1. The Astor, a free library for adults, was one of the institutions from which the New York Public Library was formed in 1895. Lydenberg 1923, 1–12, 337–48; see also Doc. 1545 n. 1.

2. Upton's list of sources is in his first literature search notebook. He had evidently consulted several of these sources already and noted that he had reviewed through 1858 *Die Fortschritte der Physik* (The Progress of Physics), an annual review published in Berlin. Literature Search Notebook #1, Upton (*TAEM* 95:375).

3. J. C. Poggendorff's *Annalen der Physik und Chemie,* published since 1824 in Leipzig.

4. Nothing is known of this subject.

5. Instead of going to Boston, Upton prepared to move to Menlo Park. He wrote his father that "the first few weeks will be lonely enough for Menlo Park is such a dreary place. The work will of course keep my mind full, and away from home-sick thoughts." Upton arrived at Menlo Park on 13 or 14 December. He reported to his brother at the end of the month that he was "getting along finely here enjoying myself very much indeed with my work. Just learning how to sleep daytimes." Upton to Elijah Wood Upton, 12 Dec. 1878; Upton to Charles Upton, 29 Dec. 1878; both Upton (*TAEM* 95:502, 506).

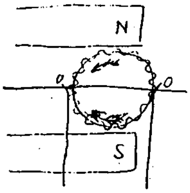
-1611-

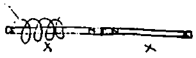
Notebook Entry: Electric Lighting

[Menlo Park,] Dec 9 1878

Gramme Machine[1]

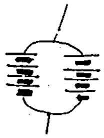
Imagine a N pole passing into a solenoid and no S to follow the current would be all in one direction.





As you pass the coil along the bars the current will be all same direction from X to X. It would be the same thing as putting ~~coil~~ bar in coil halfway and then turning it round & putting it out of the other end[2]

In Gramme armature the top half has a current running in one direction and bottom half a current in the other direction these meet at o o and the product is same as two batteries for quantity[3]



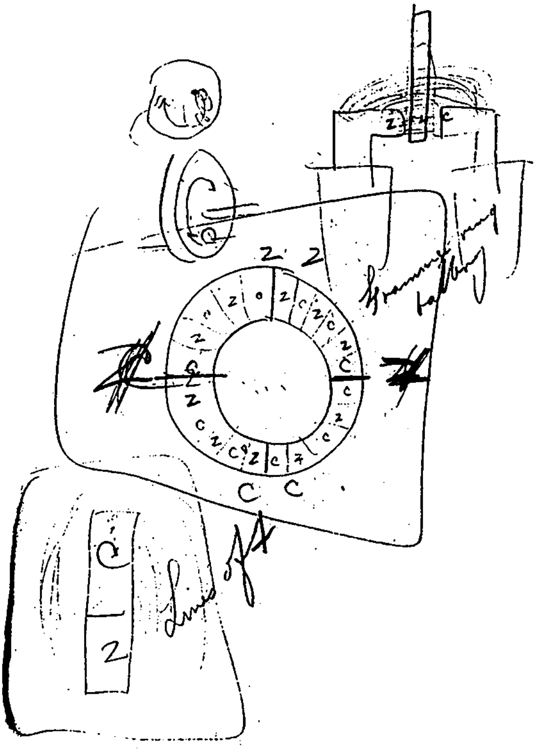
X, NjWOE, Batchelor, Cat. 1304:6 (*TAEM* 91:8). Written by Charles Batchelor. This document is photographically reproduced in Friedel and Israel 1986, 44.

1. Batchelor evidently made these notes to conceptualize the flow of current in the armature as the coils moved between the field magnets. There are several other diagrams of the flow of current through a ring armature and individual coils from mid-December in N-78-12-15.1:22–24, 27, Lab. (*TAEM* 29:953–55).

2. The letters inside the bars are from left "S," "N," "N," and "S."

3. Cf. N-79-03-20:67, Lab. (*TAEM* 33:34). In another series of drawings, Upton compared magnetic lines of force with the internal currents of a battery, "Trying to establish a relation between the magnet and Zn & Cu with currents flowing in a fluid." This line of thought became more important in early 1879. N-78-12-28:15; N-79-03-20:42–45, 57; all Lab. (*TAEM* 30:9; 33:23–24, 29).

Sketches likening a Gramme dynamo armature to multiple copper and zinc poles in a battery.



-1612-

From Grosvenor Lowrey

New York, Dec 10th 1878[a]

My Dear Edison:

The visit yesterday was productive, I think, of solid good results.[1] Our friends had their imaginations somewhat tempered; but their judgments are instructed, and we now have to deal with an intelligent comprehension of things as they are, which makes both your part and mine much easier. They realize now that you are doing a mans work upon a great problem and they think you have got the jug by the handle with a reasonable probability of carrying it safely to the well and bringing it back full.

In respect to Mr Puskas my situation and that of Drexel, Morgan & Co is a delicate one. They desire very much to control the light in all parts of Europe believing that by making one job of it, with headquarters here, the general result will be more satisfactory in every way. I suggest to you some reasons for thinking it so much more for your interest to deal with them than with people residing on the other side, as to make it proper for you to write in full to Mr Puskas enforcing your former proposition to him.

First. Before this light is introduced anywhere it must be exhibited in various places in Europe, say, for instance, London, Paris, Vienna and, perhaps, Berlin. These exhibitions should be under one control, and, to be made successful, must have your direction while preparing to make them; and considering all the numerous questions which will from time to time arise, you will be much better off if you are dealing with your own people here, at home, with the opportunity for constant consultation comparison of views &c &c.

Second: When we come to the business of disposing of the patents it may be good financial policy not to sell outright, but to reserve interests in different places, to balance one thing against another, and to draw the largest result by allowing time &c. To do this rightly requires an amount of skill and power which neither you nor I possess, but which may be possessed by a great many bankers and financial people living here and in Europe.

But, for your purposes, it ought to be a matter of the greatest comfort to have your partners, who are to account to you, right here, at your own home; people whom you can know all about, and whom you can reach by legal process if they treat you wrongly. By this means, also, you keep, through them, a controlling hand upon the development of the invention on the other side so as to enforce your views & wishes, and there may arise many occasions upon which you will be very thankful that everything is managed and controlled at the corner of Wall and Broad Streets,[2] within twenty miles of your own office. Besides that, Americans and Englishmen, as Mr Fabbri said the other day, are a different kind of men to deal with from Continental people. I believe from my own experience that Americans are the honestest and most straightforward, as well as the best hearted people in the world. I think the English are next. An American Banker, residing in Paris, once told me he longed to get back to the United States for it seemed to him as if you could deal openly and above-board with people in New York while in Paris, where he resided, there was no chicanery or trick considered to be beneath a great banker; & that it was only by having the skill to watch them, and guard yourself at all points, that it was possible to do business with them.

Of course if you had a completed thing which you were willing to sell at a given price there would be no difficulty; but if you require a given price down it must a small one; or, if you reserve interests in the future development, in order to get the larger price, you will be entirely at the mercy of people who are not only personally but by habit, education, and general ideas, strangers to you.

Drexel, Morgan & Co have their own means and agencies for watching such people, and also the power, like any other strong banking house, to force the respect of these people. They expect to see them and do business with them again.

Third: It is altogether probable that you will require more money. How much more neither you nor anybody else can tell. If you were to get some sum now, even as much as $50,000, from Mr Puskas (and if you get any amount it should be expressly stipulated that it is subject to all the risks of the business), you cannot know that that will be enough. You may ~~may~~ bring this up to a point where Anthony J Drexel, and men like him, will clearly see that the thing is sure, but that it requires, in order to put it to a test in Cities, the outlay of hundreds of thousands of dollars. If that time should come the money will be forthcoming, (if only required to find out the best method of doing an assured thing). In that case you would want all your assets here. If you should in the meantime have parted with your right to the Continental Countries it might very much cripple you.

To sum the whole matter up, you are now in the best conceivable position which the circumstances permit. You are introduced to a new class of men who entertain the highest confidence in your ability and respect for your character. They possess all the means which may ever be required; they live here, speak your own language, share your ideas as to what is honest and upright; are conveniently at hand to act as partners with you upon every question touching the preliminary development and subsequent management of what we all think is to be a great property. They supply precisely everything which you are lacking, and possess all the European influence, or the means of getting at such influence, which can ever be required.

Upon these considerations, if you are so disposed, I think you might fairly write to Mr Puskas and say that he owes to your position some consideration; that while 10% is not as much as 50%, and while it may be true that his friends possess more European influence than yours, yet yours possess sufficient, and, upon all other considerations, are preferable, for your purposes, to his; and ten per cent of what they will get is a very large return for what he has done,[b] and one for which he ought to be very grateful; while the outcome which you may expect from dealing through your friends instead of his is vastly beyond the proportion of ten to fifty. I think you might with propriety say all these things to him and urge that he who obtains so considerable an interest, as is now proposed, for so small an outlay, and for merely receiving a telegraphic dispatch, ought gracefully to yield when he finds your position, generally, requires the change.

I repeat that I feel a delicacy in pressing you about this because, of course, you know that I expect Drexel Morgan & Co to give me some portion of their profits, and I do not wish to crowd Mr Puskas any more than I should wish anybody to crowd me nor will I do so by seeking to exercise any influence upon your determination due to the fact that I am nearer to you than he is. I therefore lay these suggestions before you as rational considerations fairly affecting your own interest. I confess I should feel, however, if Drexel Morgan & Co were not to get the Continental business, that you had thrown away one of your strong cards. I do not mean to say that their interest would relax, for they would still have the American interest and the English business which would be very great, and probably plenty to satisfy them so far as the profits go; but I think they are very proud of the idea of swinging the whole thing for Europe,—it seems to enlist them as the champions and representatives, and you know how men act under such motives. Truly Yours.

G.P.L.

P.S. Enclosed please find letter from Col Gouraud.[3] I suppose the proper answer to be made to him is, substantially, that when you decided to give him the power of attorney for England nothing definite was said about his position; that in subsequent negotiations with D.M. & Co it has always been expressly provided that they were to see him and arrange with him in a suitable manner, under the circumstances; and that in your letter to me you have made that an express stipulation; and that when they are prepared to do anything upon the other side he may expect that they will call upon him prepared to give him a position and an interest such as they & he, as business men, think right.[4] In short that you have done all you can by laying before them the whole matter taking their promise that they will treat that matter liberally and fairly.

What do you think about having the two light patents, 156 & 162, issued now? My impression is that we do not want them for anything and we had better wait. This will be just as you say, however.[5] L.

The general character of the agreement proposed with D.M. & Co will show what you must do with any other European agent, if you desire to retain that constant relation to the light which that agreement contemplates— You should certainly know who Mr Puskas' parties are; in what capacity they are brought in, whether as agents to sell or as purchasers;&— whether they are prepared to place, say $ —at your disposal now, to be drawn & expended if needed in experiments— If they come forward with a liberal sum, say $50,000 (to be used only in case of necessity) & make the proper arrangements in respect to the future, you ought to accept it, & close with them— If they will not do that—except that I do not name the sum arbitrarily—I think Mr Puskas would be behaving unwisely, & unfriendly to you if he does not at once relieve you from embarrassment in the manner proposed. At any rate he should be given the opportunity to do so, again upon a full letter from you, setting out the exact state of the reasons for what is here proposed[c]

LS, NjWOE, DF (*TAEM* 18:226). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted. [b]"for . . . done" interlined above. [c]Paragraph written by Lowrey.

1. See Doc. 1607.
2. The location of the offices of Drexel, Morgan & Co., Lowrey's law firm, and the Edison Electric Light Co. Doc. 1494 n. 1; and see the Drexel, Morgan letterhead, *TAEM-G1*, s.v. "Drexel, Morgan & Co."
3. Not found.
4. See Doc. 1532.
5. Cases 156 and 162 covered thermal regulators of the current for electric lamps. They were both allowed on 7 December and issued on 22 April 1879 as U.S. Patents 214,636 and 214,637, respectively.

-1613-

Edwin Fox to James Gordon Bennett

Menlo Park, N.J., 5:26 Dec 10 1878[a]

Jas Gordon Bennett[1] NY Herald

Hold me a column and a quarter Edison[2]

Edwin M Fox

ALS (telegram), NjWOE, DF (*TAEM* 17:265). Letterhead of T. A. Edison. [a]"Menlo Park, N.J.," and "187" preprinted.

[1] James Gordon Bennett had become editor of the *New York Herald* in 1872 after the death of his father, the elder James Gordon Bennett, who had founded the paper in 1835. *DAB*, s.v. "Bennett, James Gordon."

[2] The next day the *New York Herald* printed "The Electric Light," a one and a quarter column article describing lamps that Edison had demonstrated for Fox. The *Herald* reported that two of Edison's electric light patents had just been allowed but that he had eleven applications pending and would not disclose details of his system. Cat. 1241, item 1048, Batchelor (*TAEM* 94:431).

On 9 December, William Croffut of the *New York Daily Graphic* had wired Edison, "Will you give Graphic facilities for describing and illustrating electric light." Edison replied the same day, "Yes when I am ready." Edison provided an interview for the *Graphic* later in the month in which he described his lamp and dynamo research. DF (*TAEM* 17:264); "Two Hours at Menlo Park," *New York Daily Graphic*, 28 Dec. 1878, Cat. 1241, item 1091, Batchelor (*TAEM* 94:444).

-1614-

R. G. Dun & Co. Credit Report[1]

Menlo Park Decr. 10/78.

Thos. A Edison Electrician

3700[2] Is renowned in his profession the world over. Some of his inventions have proved successes like the Stock Telegraph Machines, the Duplex Quadruplex &c &c. but the financial fruits seem to be mainly plucked by other hand. He is an untiring genius apt to run from one effort at at invention to another without fully completing the work he is on. Now claims to have solved the problem of furnishing cheap Electric light to dwellings & places where multitudes of single lights are required at less cost than gas. His claim is not yet demonstrated to be good, but if he is successful this time his ability to pay need not be questioned. He is reported to be a thoroughly honorable steady & industrious man. He must have some means but probably all his ready money is continually being planted in the expenses of his experimenting. It is impossible to Estimate his worth, or in fact to say that he has a class of assets valuable as a basis for credit 5574. 5472.

D (abstract), MH-BA, RGD, N.J. 52:290.

1. R. G. Dun & Co., established in 1841 as the Mercantile Agency, was by 1871 one of two major credit-reporting firms in the United States. See *TAEB* 1:469 n. 1.

2. This number refers to the agent making the report. The book containing the matched codes and names has been lost. The meaning of the numbers at the end of the document is unknown.

-1615-

From William Wallace

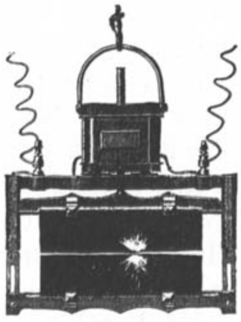
Ansonia, Conn. Dec 11 1878[a]

Dear Sir

Yours of 9 inst at hand. we have no carbons at present the size you ask for, but will make some at once and send you. The price of our lamps is ($30) thirty dollars for the large ones and $(25) twenty five for the small ones.[1] ~~e~~Our large plating machine we can let you have for $(3000) three thousand dollars it requires from 25 to 30 H.P. to drive it. The Seimens machine is in the custom House expect it in a few days[2]

What success in dividing the current, hoped to hear about it before this. am glad your patent is granted Hoping to see your invention working soon I remain as ever Yours very truly

Wm Wallace



William Wallace's arc light.

ALS, NjWOE, DF (*TAEM* 17:1076). Letterhead of Wallace & Sons. [a]"Ansonia, Conn." and "187" preprinted.

1. It is unclear why Edison wanted Wallace's carbons for electric arc lights. He paid Wallace's firm $60 for "Carbon Lt" on 21 December, the same day he sketched a lamp and listed next to it more than a dozen substances including "Carbon—Wallace." Wallace's arc light was unusual in that the carbons were "made in the form of plates, twelve inches long by two and a half wide, and half an inch thick." The carbons were "so large that they will last for ten nights, of ten hours each, and the lamp requires no care except for their renewal," owing to the simple electromagnetic regulator that kept them separated from each other in a large rectangular metal frame. There were, however, no "means for maintaining the light at a given point, so as to use it in connection with a reflector." Electric Light Co. Statement Book, Accts. (*TAEM* 88:444); Vol. 16:315, Lab. (*TAEM* 4:748); Prescott 1878c, 412; Prescott 1879, 511–12.

2. Wallace had evidently offered Edison the use of this Siemens generator. Edison made sketches of its field magnets, armature, and commutator wiring on 17 December (Doc. 1627).

-1616-

Notebook Entry: Telephony

[Menlo Park,] Dec ~~10th~~ 12th 1878

New Receiver[1]

Tried experiment with button made of Ferrid cyanide Pottassium one half, chalk one half—and small amount of Caustic Soda—did not work couldent hear it[a]

Made saturated solution Caustic Soda such as in crock—and made button of chalk with strong Solution also one of Woodbridge clay with same solution[a]

Button of woodbride Clay—~~n~~Caustic Soda after being in box 24 hours is non Conductor[a]

Button of Chalk and Caustic under same Conditions measured 3000 ohm res—[b]

Make button for receiver of Sulphate Magnesia and Sulphate Soda[a]

Button of Sulphate Magnesia and Sulphate Soda with about half chalk—

Button of sulphate magnesia and Sulphate Soda with Small amount of chalk—[a]

Testing button Sulphate Soda Sulphate Magnesia with about half chalk is an non Conductor, put in box—no[2] ~~1~~200[a]

Testing button Sulphate Soda Sulphate Magnesia—with Little Chalk—is non Conductor put in box for testing no 201.[a]

Phosphate Lime and Sulphate Soda Button receiver Size[c]

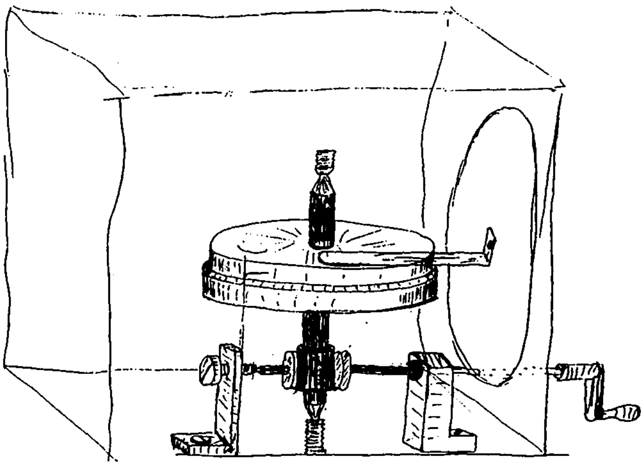
Phosphate Lime with strong solution Caustic Soda[a]

Chalk Button for Receiver with Solution Sulphate soda[a]

Chas. P. Edison

X, NjWOE, Lab., N-78-12-02:51 (*TAEM* 29:459). Written by Charles Edison; document multiply signed and dated. [a]Followed by centered horizontal line. [b]Followed by centered horizontal line and heavily canceled word. [c]Followed by two centered horizontal lines.

1. On 2 December, Charles Edison had begun an extensive search for chemicals with which to make a more enduring electromotograph receiver. He undertook "Experiments with differant mixtures to find out differant or change in resistance of Button when left in crock with water." By 12 December he had tested nearly two hundred compounds, most of which he noted either made fragile buttons or were poor conductors. He tested several dozen additional materials between 13 and 15 December. On 16 December, Charley drew a new form of receiver in which the button was a thin disk mounted on a base and turned on a vertical axis. The following day he continued "Experiments to determine conductivity of differant chemicals." Between then and 22 December he tried more than six hundred substances, including various nuts, chewing tobacco, pussy willow bark, and "bitter orange peel." Most were nonconductors, but on 22 December Charley recorded "HAIR From a BAT with Carbon" as a good conductor. On 24 and 26



Charles Edison's 16 December telephone receiver design.

December he tested "paper soaked with differant oils for conductivity." Charley continued experimenting with electromotograph buttons in January. Vol 18:100; N-78-12-02:3–227; both Lab. (*TAEM* 4:1132, 29:443–547).

2. That is, "number."

-1617-

From George Barker

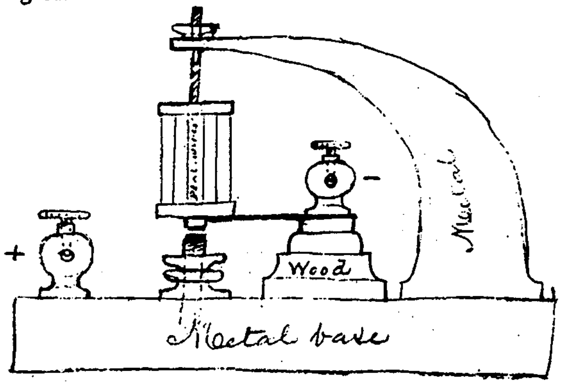
Philadelphia Dec. 14. 1878.

My dear Edison:—

I received a letter from Mrs. Thornburgh[1] of pleasant Fort Steele [Wyoming] memory, the other day acknowledging the receipt of the photograph of yourself which I sent her, and desiring me to remember her to you and thank you for the picture. She enclosed the slips of paper with which I have headed this letter.[2] The Major had just returned from a trip to California with some friends. They had a good time.

We were of course very sorry not to see you at Dr. Draper's last week. There were many inquiries after you and I think you would have had a pleasant evening had you come over. Dr. Draper gave a capital familiar talk, as he knows so well how to do, upon the progress in illumination made by the human race, and gave some fine electric light experiments with the electric candle of Jablochkoff, with a beautiful little plate lamp which Mr. Wallace made for him and with a Werdermann lamp also made by Mr. Wallace. The little Gramme machine of Dr. Drapers ran it all nicely. Wallace also brought on some of the new carbons he is making which are the best I've ever seen being harder even than the Carré carbons[3] and from 1/16 to ¾ an inch in diam.

I went down town on Friday and saw in Mr. Maxim's office in the Equitable Building,[4] a form of platinum light which I thought might interest you and which therefore I enclose a drawing of.[5]



It is not quite high enough vertically, on my paper. You will readily understand it. The current entering by the positive binding post passes through the metal base and arm to the gridiron of platinum wires and through them to the brass spring and to the negative binding post. As the wires heat they expand and the platinum-faced surface under them being brought in contact with a similar one under it, the current is shunted round the platinum wires till they cool again. The lamp I saw was made over a year ago. Maxim you know is running a Wallace machine in the basement of that building for his two lights;[6] but he has taken off Wallace's name. It is running duplex;[7] and has been used steadily for 6 mos. from 8 A.M. to 9 P.M. without requiring a moments attention.

Another thing I heard which I thought you ought to know. I was told at the Century Club that A. K. Eaton of Brooklyn had patented a metallized button for a transmitting telephone which could take the place of your carbon button perfectly.[8] Today I heard of it here as being louder and producing better articulation than the carbon button. What are the facts of the case?

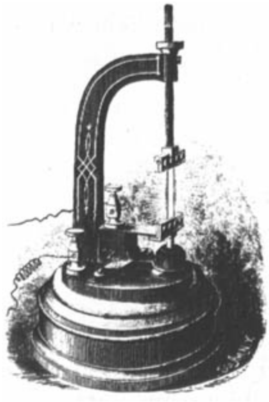
Mr. Wallace desired me to say to you when I wrote again that if you desired to try any experiments with quantity magnetos, or with those of any desired internal resistance he would be very glad to put his collection of machines (almost of every conceivable pattern) at your disposal in Ansonia, as well as his power etc.

When Mrs. E. & the baby are strong enough Mrs. B. and I will come on and spend a day with you. Yours truly

Geo. F. Barker.

ALS, NjWOE, DF (*TAEM* 17:1081).

1. This was presumably the wife of Major Thomas Thornburgh, who was stationed at Fort Steele. In September 1879, Thornburgh was killed while trying to put down a Ute rebellion at the White River (Colo.) Agency in Indian Territory near where Edison and Barker had gone hunting during the summer of 1878; see App. 1.A[4]. Knight 1960, 299–300; Dunn 1886, 698–701.



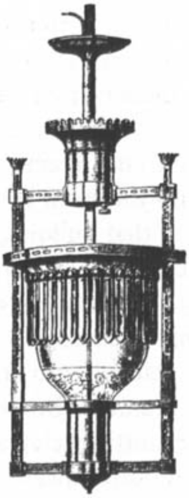
Hiram Maxim's 1877 platinum burner electric light.

2. Barker attached two short clippings from an unidentified newspaper. These farcical items attributed a woman's purported insanity to ill-fitting pantaloons and claimed that Edison was "at work on an invention to keep pantaloons from bagging."

3. E. Carré of France was among the largest manufacturers of electric carbons. In 1876 he had patented a composition "consisting of powdered coke, calcined lamp black and a particular syrup formed of twelve parts of gum and thirty of cane sugar." These were considered stronger than retort carbon and were better conductors but wasted more rapidly and produced small sparks and an irregular light. Prescott 1879, 431–32; Dredge 1882–85, 1:354–56.

4. Hiram Maxim was chief engineer of the United States Electric Lighting Co. at this time. The company had been formed by the Equitable Life Assurance Co. and had its offices in Equitable's building at 120 Broadway in New York. An accomplished inventor, Maxim had experimented with both incandescent and arc lighting and subsequently became a determined rival of Edison. He moved to England about 1882, where he invented an automatic machine gun and a form of smokeless powder; he was knighted in 1901. Passer 1972, 147–48; *DNB,* s.v. "Maxim, Sir Hiram Stevens"; Wilson 1879, 433.

5. Vertical text at center is "Plat. wires." Maxim had invented this lamp in 1877 but never patented it, "because he found by experiment that it required a much greater expenditure of power to produce a given light with it than was required with the carbon points." Prescott 1884, 233–35.



Fixture for Hiram Maxim's arc lights in use in 1878.

6. Maxim used two arc lights of his own recent design to illuminate a corridor of the Equitable building. His lamp had automatic feed mechanisms to advance each carbon at the rate it was consumed, thereby keeping the arc itself in the same place. The lamp had

> a silvered reflector, of suitable shape to throw the beams that would be wasted above in a horizontal or downward direction, and from this reflector two rows of prisms are suspended. One half of the prisms are arranged with their flat side to the light, and the other half have their angular side toward the light. Below the focus is a bowl shaped glass, having a zone ground just wide enough to be always between the eye of a near observer and the luminous arc. The point from which the light is emitted appears from a distance diamond shaped and quite large. Thus modified, the light can be looked at with perfect ease, while its brilliancy does not seem to be at all impaired, the ground glass portion of the globe only being between the eye and the luminous point.

Powered by the Wallace-Farmer generator, these lamps reportedly provided more light than the gas jets they replaced at less than one-third the operating cost. Prescott 1879, 479–81,512.

7. The Wallace-Farmer machine was similar to other contemporary generators in using a duplex armature; that is, one having two independent circuits. In the Wallace-Farmer design a series of coils was placed around opposing faces of an iron disk. The coils on each side were wired into a single circuit but were not connected to those on the other side. These separate circuits constituted "a double machine, each series of coils, with its commutator, being capable of use quite independently of the other; but in practice the electrical connections are so made, that the currents generated in the two series of armature coils pass through the field magnet coils, and are joined in one external circuit." The Wallace-Farmer generator collected the current through a single commutator, although duplex machines in general could have a separate commutator for each armature circuit. Prescott 1879, 445–56; Thompson 1905, 83.

8. On 18 November, Asahel Eaton had filed a patent application for a transmitter button of metallic powder in an elastic matrix. The patent issued on 29 July 1879 as U.S. Patent 217,930.

-1618-

From Uriah Painter

WASHINGTON, D.C. DEC 14 1878[a]

My Dr E.

I find that under pretence of acting for the Phono Co' Mr Roosevelt has obtained from you a relase from the obligation to pay you a definite sum per annum on the "Toy Contract,"[1] & immediately made it over to Russell & now both Roosevelt & Russell are at work trying to sell that concession to the Phono Co'. I regard Mr Roosevelts conduct as dishonest & shall not allow the Co to purchase what he now proposes to sell ie a one half interest for $2,000. & the Co' to obligate themselves to spend whatever money ~~Harris~~ Russell[b] wants it to do, & to have no authority to do ~~wha~~ anything whatever with it or about it that does not first recieve the approval of Russell—[2] A dead beat, who has never put in one cent, & who has put a mortgage upon it of 7½ per cent to James asignee—which I am told is Harris

You have been overreached by these men, who mean to swindle you just as one of them tried to do on Phonograph by having the Co sell at the minimum price to agents & letting agents make the money—& you whistle for your royalty—Unless you now create furthur value to the Toy contract they can do nothing with it— There has been a good bit of crookedness in it for eight months & I want you now to agree to keep hands off it for the present— Johnson & I have now got the Phono Co in a good shape, we have done the square thing by you we have put up our money squarely & made your interests always the first thing with the belief that you would appreciate it if we made it a success & let us try something else—

Whether we ever do anything more for you or not, I want you to stand by us on this— If you had not given Roosevelt that release & put him in position to hold the Toy contract for four years more without doing anything or paying you a cent, we would have had it for the Phono Co' unencumbered before July 1

Please let me hear from you— Yours

U H Painter

⟨U.HP. I will do nothing further about it without consulting you TAE⟩

ALS, NjWOE, DF (*TAEM* 19:165). [a]Place and date from *Philadelphia Inquirer* handstamp. [b]Interlined above.

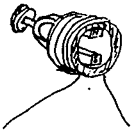
1. See Doc. 1499 n. 4. On 13 December, Roosevelt had asked Edison's permission to amend this release by substituting "the word 'apparatus' for 'toys' as it so reads in the original contract." Edison's marginal notation on that letter reads, "Copy to UHP What about it E." Roosevelt to TAE, DF (*TAEM* 19:163).

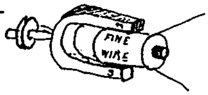
2. Painter wrote Edison again on 22 December, charging "that the recent concession was given by you to him [Roosevelt] for the Co' in order that the whole interest might be in one concern— That in violation of this he immediately assigned it to Russell & then refused to sell to the Phono Co anything but a privelge to spend money." He also claimed that "Roosevelt has threatened to make Phonographs under the Toy contract & is acting very badly." Edison replied in the margin, "will not do anything with R." DF (*TAEM* 19:168).

-1619-

Notebook Entry: Electric Lighting

[Menlo Park,] Dec 15th 1878[a]

Magneto Machines 

See what sort of a current if any you can get from this arrangement a permanent magnet revolved rapidly inside a spool of wire[1] or: so:— 

Drive a magnet round rapidly in between the poles[2] put one of our induction spools and see what current

X, NjWOE, Batchelor, Cat. 1304:8 (*TAEM* 91:10). Written by Charles Batchelor. [a]Followed by centered horizontal line.

[1] This is one of several experiments and analyses devoted to clarifying which motions, arrangements, and parts of generators do not contribute to, or in some way inhibit, the generation of current (see, e.g., Docs. 1628 and 1641).

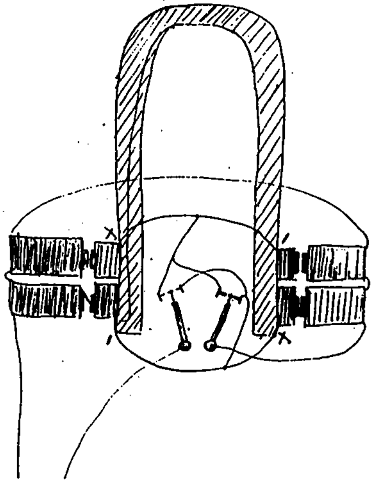
[2] Poles are labeled "N" above "FINE WIRE" and "S" below.

-1620-

Notebook Entry: Electric Lighting

[Menlo Park,] Dec 15th 1878

Electric Light[1]



I find most current when induction magnets are connected together[2] from X to X & 1 to 1

We get a very slight current owing to the magnets not having play enough[a]

They never get far enough[b] away from the feild of force

We want more amplitude of vib. in fork[a]

With plain fork with 9 cell C[ondit] & H[anson] we get on end of fork[a]

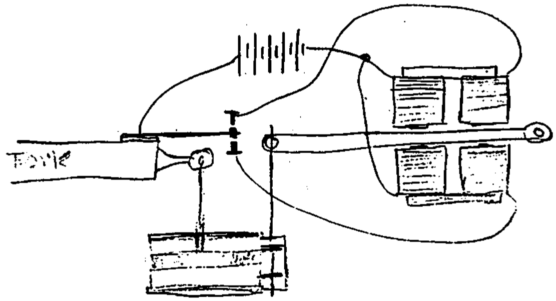
24½	inches of fork	vibration	.10 of inch
17	" " "	"	.06—
11	" " "	"	.04 of inch

With weights when tuned up

24½	inches	vibration	.14 of inch
17	—	—	.07
11	—	—	.045

TAE Chas Batchelor

X, NjWOE, Lab., N-78-11-28:31 (*TAEM* 29:35). Written by Charles Batchelor. [a]Followed by centered horizontal line. [b]Interlined above.



Detail of linkage for a tuning-fork dynamo.

1. For earlier work on the tuning-fork dynamo see Docs. 1427 and 1547. In the patent application Edison had executed on 3 December (Pat. App. 218,166), he stated that "this vibrating bar or fork may be two metres long more or less, and heavy in proportion, it has its regular rate of vibration, like a tuning fork, and the mechanism that keeps it in vibration is to move in harmony; a crank and revolving shaft or other suitable mechanism may be employed, but I prefer a small air, gas, or water engine, applied to each end of the fork." In the patent drawing of the engine, the regulating valve is moved mechanically by the fork. On 11 December, Batchelor had sketched what appears to be a detail of this linkage and drew the entire engine with the valve actuated by battery current. He also listed possible modifications to the engine and its connection to the fork. N-78-11-22:13–17, Lab. (*TAEM* 29:159–61).

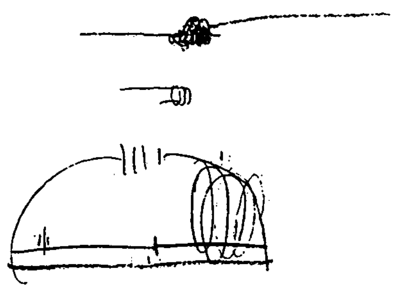
2. Edison drew a similar fork the same day with a different wiring arrangement, but labeled it "no good." Another fork and Batchelor's sketch of commutator switches follow. N-78-11-28:25–29, Lab. (*TAEM* 29:32–34).

-1621-

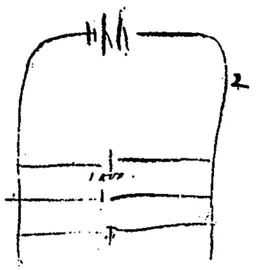
Notebook Entry: Electric Lighting

[Menlo Park,] Dec 15/78

Dynamo Mac[1]



~~10 ohm~~ 100 of 1 ohm each 100 ohm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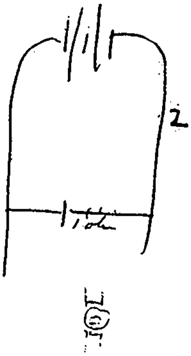
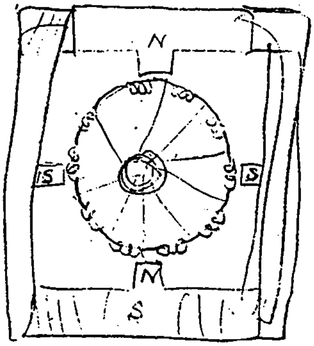
1 ohm


2
1 ohm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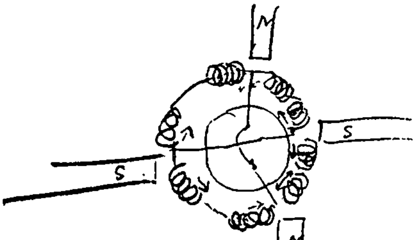
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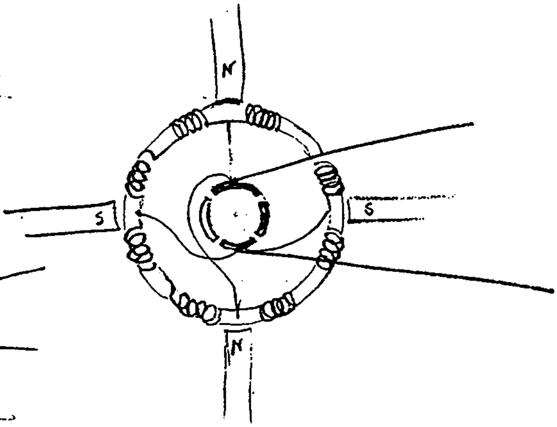
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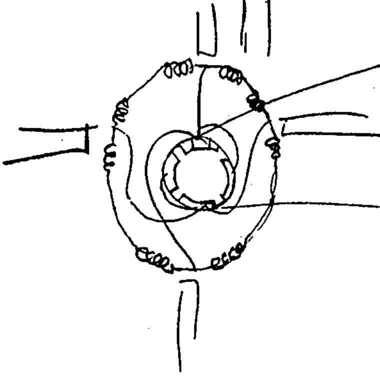

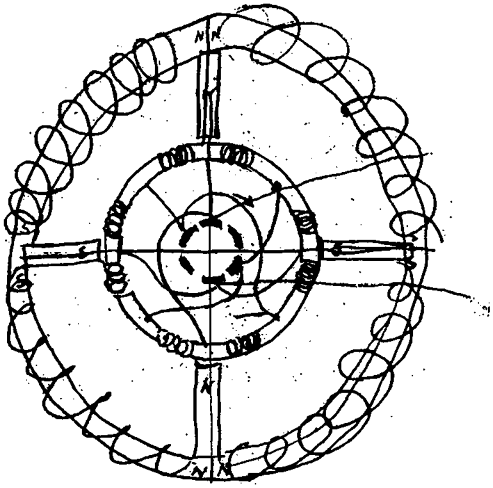
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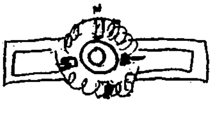
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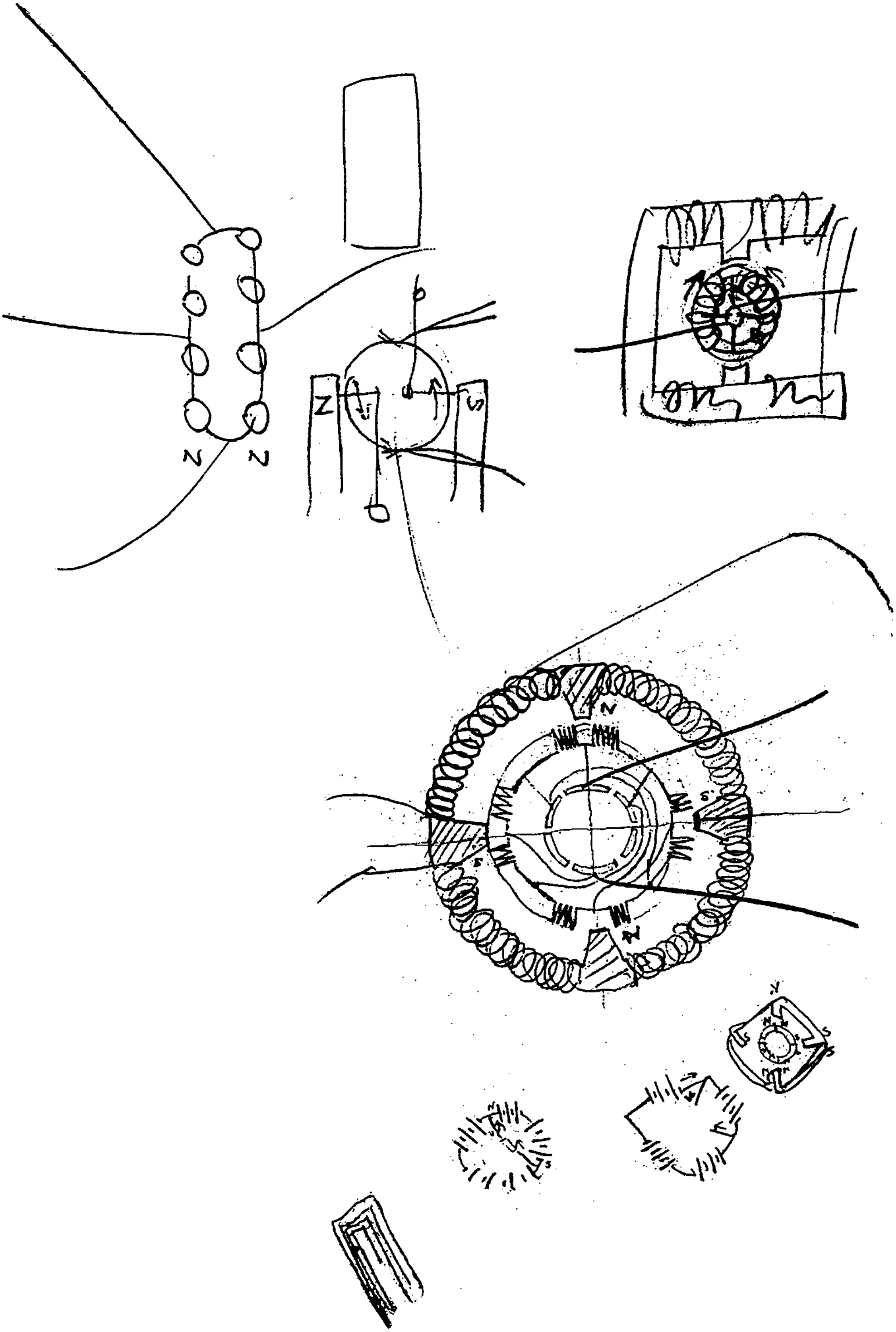
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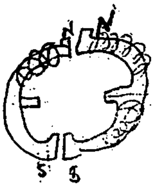
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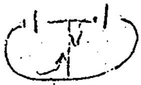

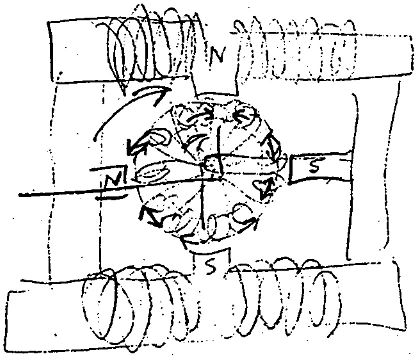
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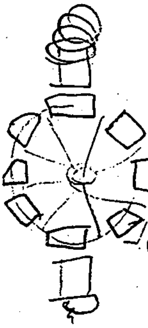

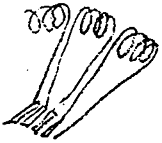

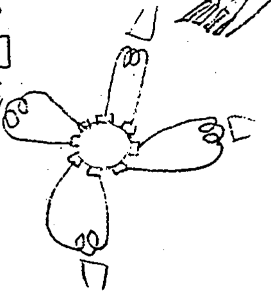

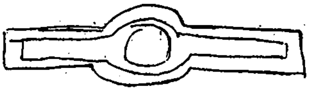

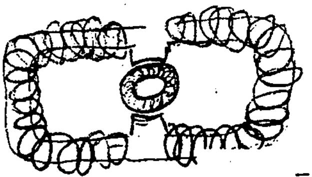

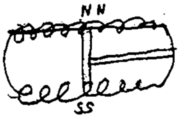
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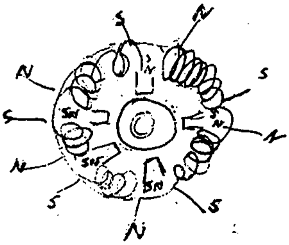
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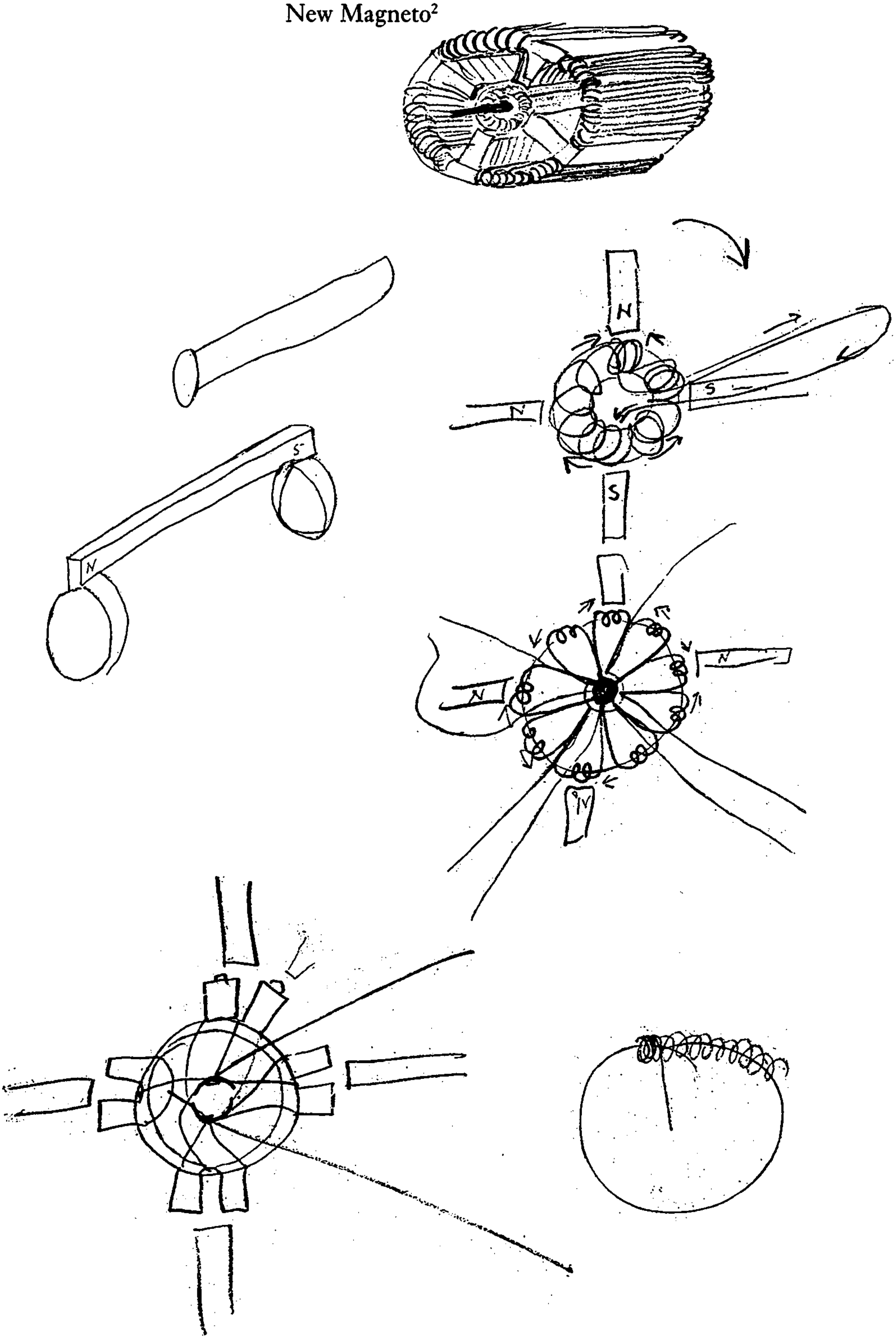
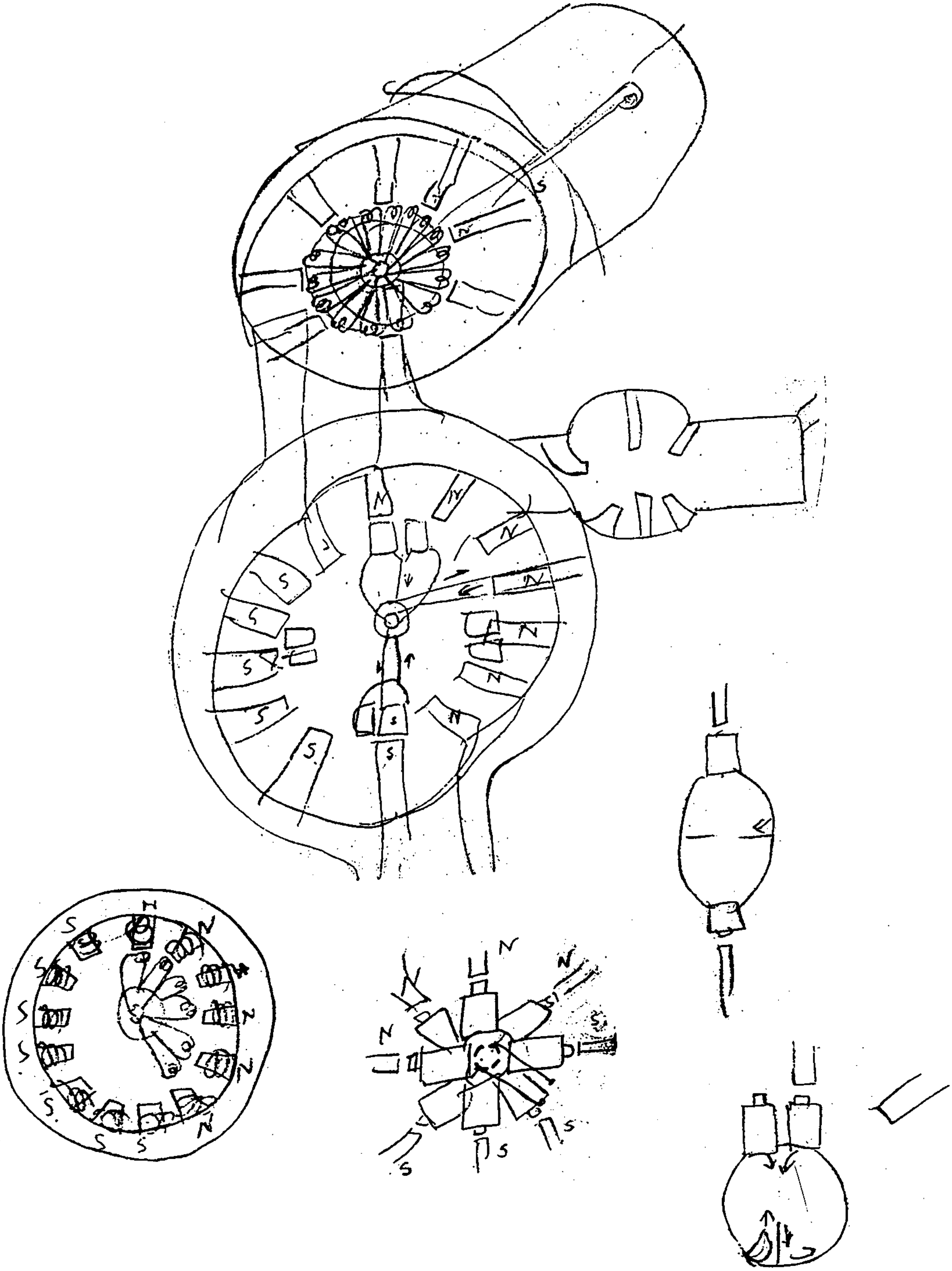
New Magneto[2]

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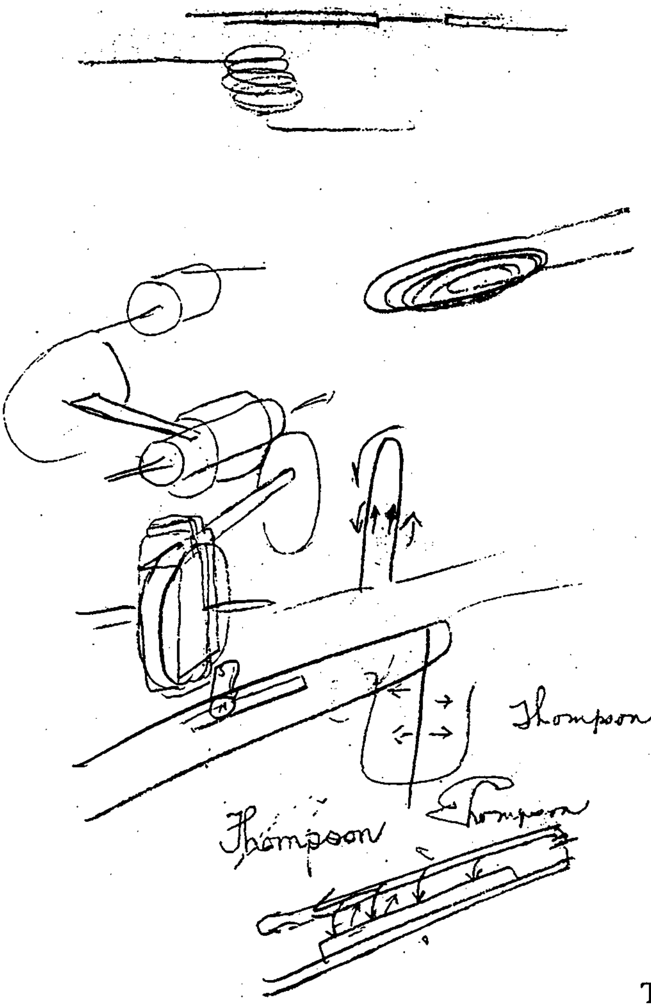
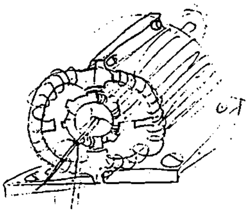


TAE

X, NjWOE, Lab., N-78-12-15.1:3–13; N-78-12-15.2:22–39 (*TAEM* 29:943–47; 40:316–24). Document multiply signed and dated.

1. In these drawings Edison considered a variety of armature configurations and their relationships with field magnets. They mark the beginning of his first sustained effort at designing generators. Most of the sketches involve ring armatures combined with multipolar field magnet arrangements similar to those used in large Gramme generators and to designs by De Meritens. King 1962c, 380–89; Dredge 1882–85, 1:197–201.

2. The shape and proportions of the first machine below resemble one shown in a dynamo design drawn by Edison on 30 November. The armature appears to be tubular in form, like a design later employed in a Maxim generator. Several of the later sketches show pole armatures surrounded by multiple-pole field magnets, similar in some ways to the arrangement of the Weston generator Edison had purchased. Vol. 16:305, Lab. (*TAEM* 4:742); Dredge 1882–85, 1:224–5; Prescott 1884, 659–9; cf. Doc. 1508 n. 2.

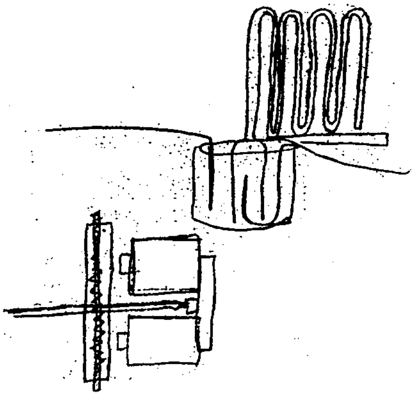


Dynamo design of 30 November.

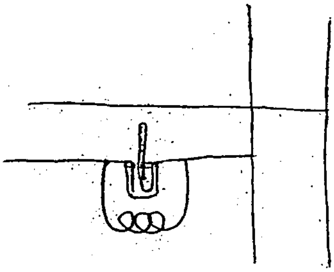
[Menlo Park,] Dec 15/78

Notebook Entry: Electric Lighting

Meter[1]

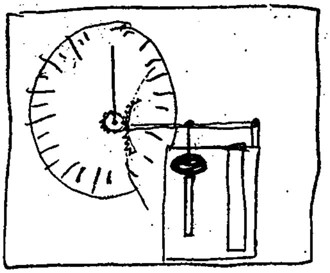


I propose to shunt a small quantity of the current through a decomposing cell of Ag or Cu & weight the deposit every month to determine

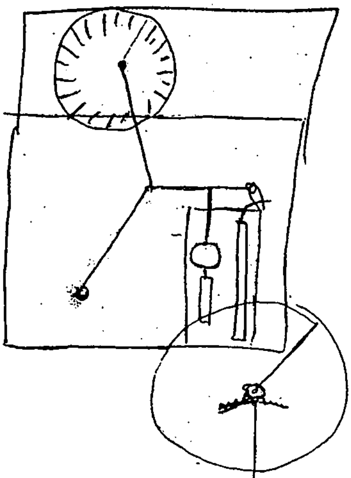


the current consumed—[2] I could use the gas evolved by electrolysis but deposit is better as there is no polarization.[3a]

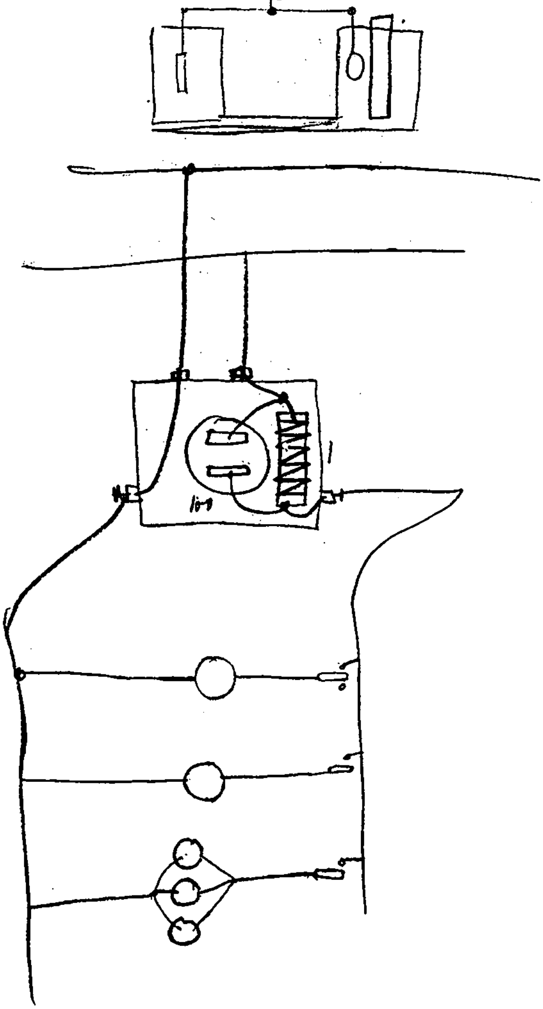
No 1

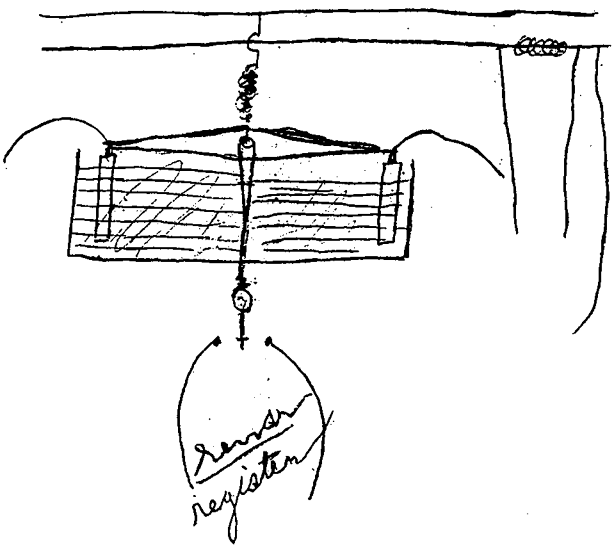


No 2



No 3[4]





TAE John F Ott

X, NjWOE, Lab., N-78-12-15.1:15 (*TAEM* 29:948). Document multiply signed and dated. [a]Followed by centered horizontal line.

1. In interference testimony, Edison claimed that he had conceived this meter design in October and had it constructed in October and November, but this notebook entry marks the first extant evidence of such a design. He recalled that

> The apparatus consisted of a cell with a fixed copper cylinder in the cell. This cell was filled with sulphate of copper. The other electrode was a plate of copper suspended by a spring. A lever connected to the plate came in contact with electrical stops at the extremity of the movement of the plate, in either direction. When the plate had become heavy by decomposition of copper it moved down into the liquid until the lever touched one of the contact points closing an electric circuit, which actuated a reversing apparatus for reversing the direction of the current through the electrode of the cell. The plate then became lightened from copper taken off of it by electrolysis, which continued until the lever came in contact with the upward point. When the current became again reversed, and so on. A ratchet wheel and magnet actuating a counter recorded the number of reciprocations of the plate. [Edison's testimony, p. 6, *Sprague v. Edison* (*TAEM* 46:324)]

The drawing of the electromagnet apparently represents a polar relay with some kind of recording point to act as a counter. Each time the current reversed it would presumably make a mark.

2. Charles Batchelor recalled that

> It seemed to be a favorite idea with Mr. Edison to measure electricity by means of depositing the metal and making the weighted plate tell, first, by weighing and afterwards by recording the amount of electricity that passed. The first experiments of this

kind that I remember were simply electrolytic cells in which the metal was taken off one plate and deposited on the other, one of which plates was weighed in order to tell how much current has passed. Mr. Edison also made experiments with a similar cell, in which the plate to be weighed was provided with a pointer, which, as the metal got heavier would indicate the amount of current that was passed. This plate was suspended by a spring in some cases, and in other cases was mounted on a counter-balance arm so that the plate fell and rose in the liquid as the current was reversed. He also made meters on the electrolytic principle that were automatic in their action, inasmuch as the weighted plate would pull down a scale beam, and at a certain point would reverse the current so that the other plate could receive a larger portion of metal, and so pull the scale beam in the opposite direction. On such devices recording arrangements were placed which would keep a record of the current that had passed by counting the number of oscillations that the lever had made. [Batchelor's testimony, pp. 12–13, *Sprague v. Edison* (*TAEM* 46:327)]

3. Polarization, the accumulation of ions on electrodes in an electrolyte, increasingly impedes the flow of current. In the drawings below (Nos. 1–3), as one electrode gains weight through deposition it pulls down a lever connected to a dial gauge. In meter drawings of 20 December, Francis Upton showed a linear "scale for measuring" the amount of deposition. N-78-12-16:17, 19, Lab. (*TAEM* 29:1085–86).

4. In the drawing of the lamp circuit (following meter design No. 3) the shunt with the decomposing cell is shown at the top; the figure label is "100." In the final drawing the figure label is "revrsr register."

-1623-

From Elisha Andrews

New York, Decr. 16, 1878[a]

Dr Sir

I have endeavoured to see you several times in relation to autographic telegraphing Every appointment you have made, you have been obliged (from press of business I presume) to omit to keep—[1] I saw Doct Greene today & he said you had stated to him that the contract between yourself myself, Field & Lefferts was to be given up. to you The contract shows for itself what the agreement was, after we had advanced you money for experimenting beyond the time specified, you said, after the failure of the last experiment that you made. "You have advanced money enough. I have failed thuse far but some time I shall see how I can perfect the invention & I will do that at my own expense for the benefit of the contracting parties"— I have your written agreement to that effect.— Nothing was said about surrendering the contract, & such a thing was never contemplated, by you or myself—[2]

I understand Mr Kenney has a device which will enable you to perfect this important improvement.[3] & I think from my conversation with Doct Greene, that the W.U. Co. would be willing to pay to have the experiment tried if they could control it, if it was a success.— I am willing on my part (& think I can get the consent of the other parties in interest) to agree to a fair arrangement if the experiment can be tried— If you would meet me, & come to a conclusion as to an agreement of terms. the matter could soon be settled by Kenney, as to its practicability. Will you do so, or will you not. I do not wish to keep the matter in this uncertain state (so far as Kenney is concerned) any longer I have confidence that it may prove to be one of your great successes— Yrs Truly

E W Andrews[4]

ALS, NjWOE, DF (*TAEM* 19:570). On letterhead of the American District Telegraph Co., President's Office. [a]"New York," and "187" preprinted.

1. Andrews and James Gamble, general superintendent of the American District Telegraph Co., had tried at least five times since September to make an appointment with Edison in Menlo Park. Edison agreed to meetings on 4 and 24 October but broke both engagements to go to New York on other matters. Andrews to TAE, 6 Sept., 3 and 14 Oct. 1878; Gamble to TAE, 10 and 23 Oct. 1878; TAE to Andrews, 3 Oct. 1878; TAE to Gamble, 23 Oct. 1878; all DF (*TAEM* 19:545, 552, 555–66, 563).

2. Docs. 92 and 755.

3. See Docs. 1328 n. 3 and 1388 n. 6.

4. At this time, Elisha Andrews was president of the American District Telegraph Co. and a director of the American Speaking Telephone Co. Reid 1879, 632; see also *TAEB* 1:153 n. 2.

-1624-

From George Bliss

Chicago Dec 16th 1878[a]

Dear Sir.

S. B. Grimshaw, Manager of the telegraph office at Independence, Kansas, is anxious to obtain a sample of your handwriting. He rendered me a good deal of service in the purchase of the Huffman patent.[1] On account of his kindness in your interest, which was gratuitous, I should like to have you gratify him. You would be astonished if you could realize the extent of your reputation in the country. Many of the papers start their advertisements, about as follows,

Edison has accomplished marvelous things by the transmission of four messages over a line at the same time, & has thereby done great service to mankind; but the peculiar kind of bitters which we offer to the public give advantages beyond anything heretofore offered; &c.

It is the same in regard to supplying articles of every kind, useful and ornamental I did not find a man too remote from railway & telegraph centers to know you & who was not interested in your achievements. Such is fame. Respectfully.

Geo. H. Bliss Gen. Man.

LS, NjWOE, DF (*TAEM* 16:516). Letterhead of Edison's Electric Pen and Multiplying Press, George Bliss, General Manager; letterhead and dateline are electric pen copy. [a]"Chicago" and "1878" preprinted.

1. See Doc. 1559. In a letter of 29 November, Bliss had reported to Edison that after going first to Carthage, Ill., he "travelled day and night by rail and team and tracked Huffman through Illinois, Missouri and Kansas" before finding him "on the state line between Kansas and the Indian territory 60 miles from the nearest railroad." Because "other parties" were also chasing Huffman, he "had to resort to every artifice to throw them off the track and conceal my movements." Bliss succeeded with the help of "a friend who is a dealer in patents and who took along a patent steam cooker which we pretended to be selling to farmers." DF (*TAEM* 18:355).

-1625-

From Lemuel Serrell

New York, Dec. 16 1878.[a]

My dear Sir

The ~~confounded~~ newspaper men are doing you more harm and producing more trouble ~~than they are worth~~: I am just in receipt of another opposition to your German patent on the Phonograph, which is based on the publication in the Scientific American, reproduced in France.[1] As I told you at the time I was fearful that this publication in S.A. would give trouble, and so it has turned out: I have written to Thode & Knoop[2] giving them the best instructions as to the manner of meeting this opposition and hope that it may be overcome ~~by good generalship~~, but I see no other way of meeting the matter—[3] Yours truly

Lemuel W. Serrell

ALS, NjWOE, DF (*TAEM* 18:845). Letterhead of Lemuel Serrell; overstriking apparently added later by Edison. [a]"New York," and "187" preprinted.

1. This apparently refers to Doc. 1150 rather than the *Scientific American* article discussed in Doc. 1388 n. 12; the French reprint has not been found. On 11 November, Serrell had notified Edison of opposition to his patent based on the claim that a description of the phonograph

had been published in Germany in January or February, before the application was filed there. DF (*TAEM* 18:799).

2. Presumably patent attorneys; the firm was located in Dresden. Thode and Knoop to Serrell, 18 Sept. 1878, DF (*TAEM* 18:761).

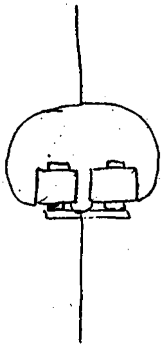
3. Edison gave this letter to the *New York Sun* as justification for withholding details of the electric light. According to the *Sun,* a reporter suggested that he might get the desired information at the Patent Office, to which Edison replied, "You can't get the specifications at the Patent Office. They are kept secret until the patent is taken out. Several patents on the light have been granted, but I am not compelled to take them out inside of six months. The publication of these specifications at this time would prevent my getting my patents in Europe. Otherwise, I would gladly give you the specifications." The *Sun* also printed an edited version of Serrell's letter followed by Edison's comment that "I know that none of the newspaper boys would willingly injure me; yet that speaks for itself." "The Genie of Menlo Park," *New York Sun,* 19 Dec. 1878, Cat. 1241, item 1066, Batchelor (*TAEM* 94:436).

-1626-

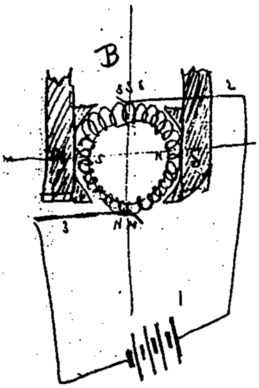
Notebook Entry: Electric Lighting

[Menlo Park,] Dec 16th 1878.

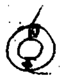
Gramme Machine



Why does the Gramme machine run so fast by battery and have no dead point (apparently)? What is the action there[1]



B is a gGramme M[achine] with commutators in place. When battery is put on at 1 it tends to form a N & S pole in the ring on each side with opposing poles. making one magnet so:—



When these are formed they are immediately attracted by the magnets and the field armatures reaching so far round the coil and the spring contacts covering more than one contact leave it so that it always will draw either one way or the other.[2]

X, NjWOE, Batchelor, Cat. 1304:9 (*TAEM* 91:11). Written by Charles Batchelor.

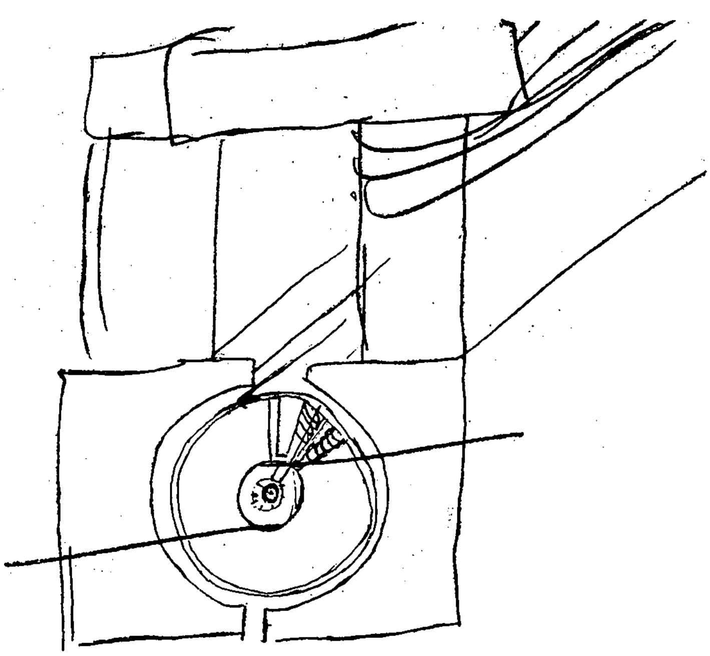
1. A rough undated sketch showing the location of dead points on a Gramme armature is in N-78-11-22:23, Lab. (*TAEM* 29:164).

2. Batchelor is apparently referring to the fact that each "spring contact" touches at least two commutator bars at all times. The armature will always be polarized because the commutator's rotation will not interrupt the flow of current.

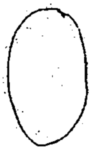
-1627-

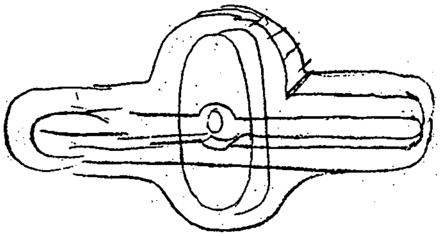
Notebook Entry: Electric Lighting and Telephony

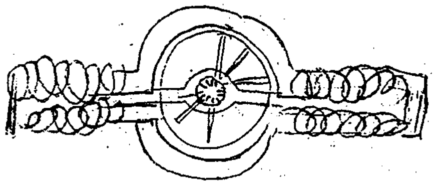
[Menlo Park,] Dec 17 1878

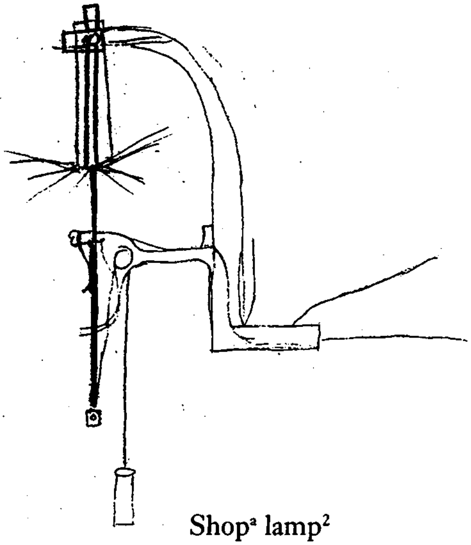


Dynamo machine De Meriton form[1]



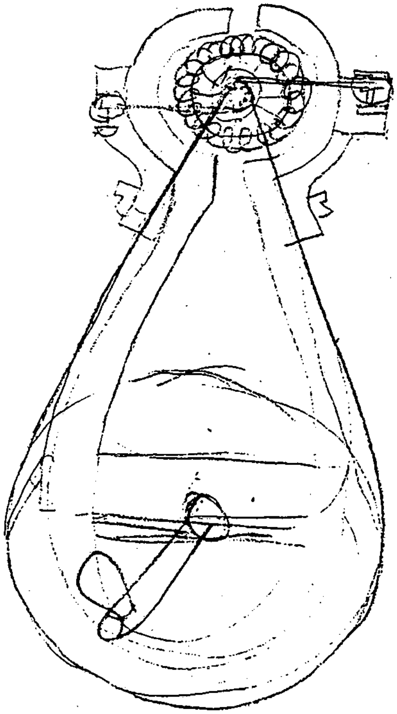




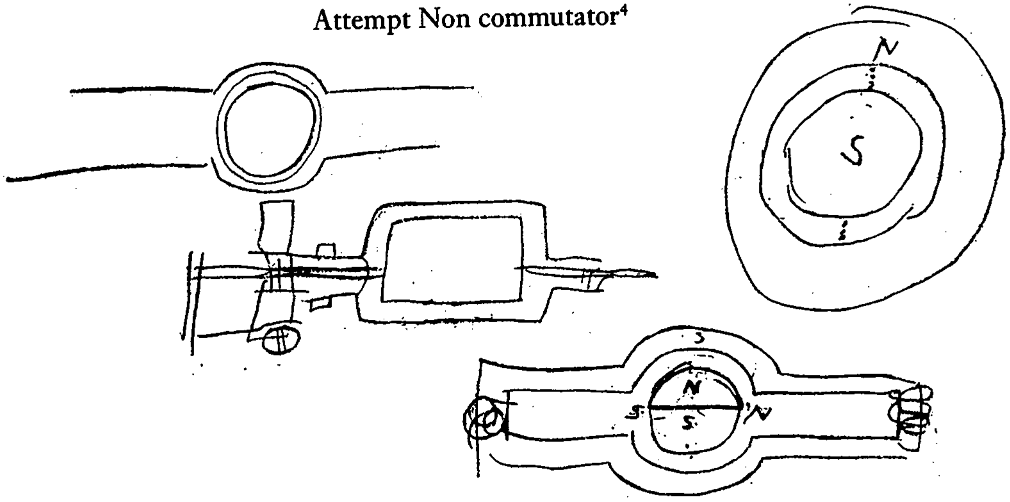


Shop[a] lamp[2]

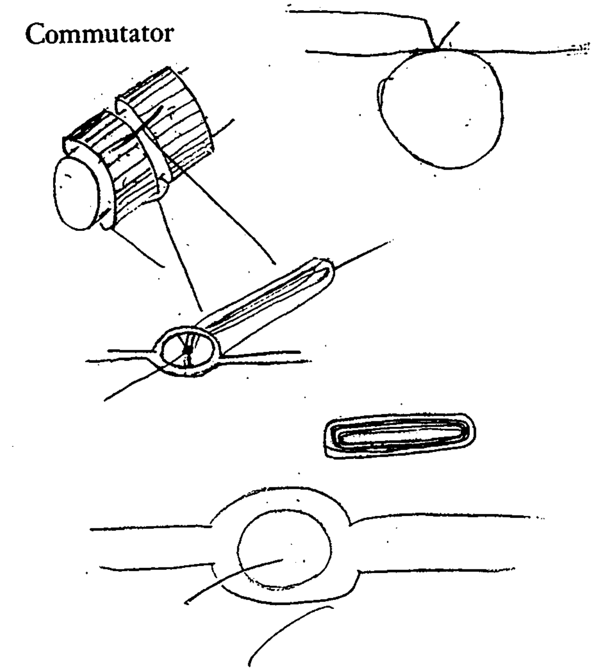
gramme Mach combined with induction coil of Carbon Telephone & Motophone Telephone[3b]



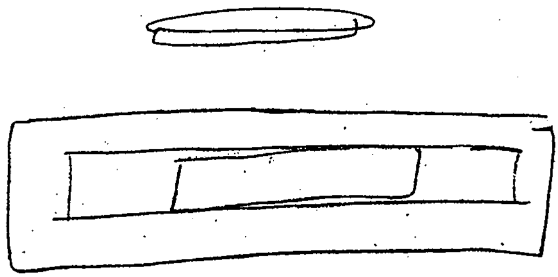
Attempt Non commutator[4]

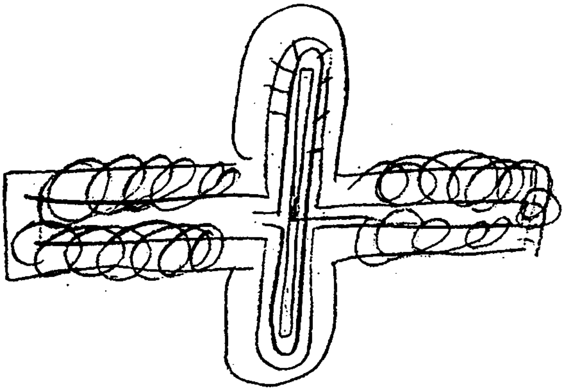


Commutator

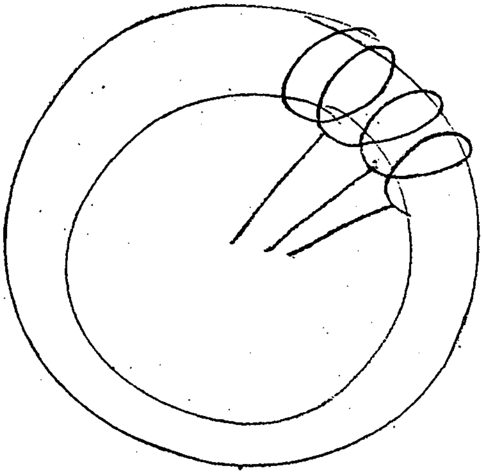


Siemens form of[5]



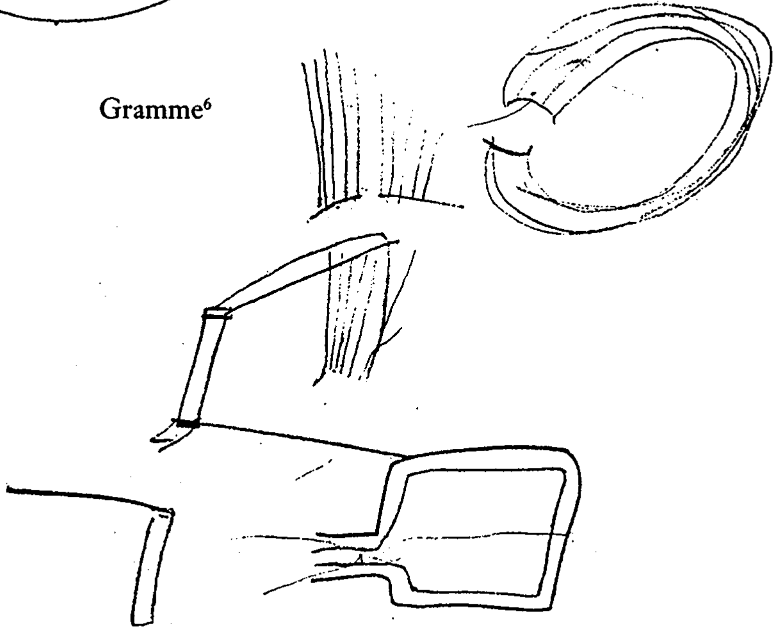


Gramme ring

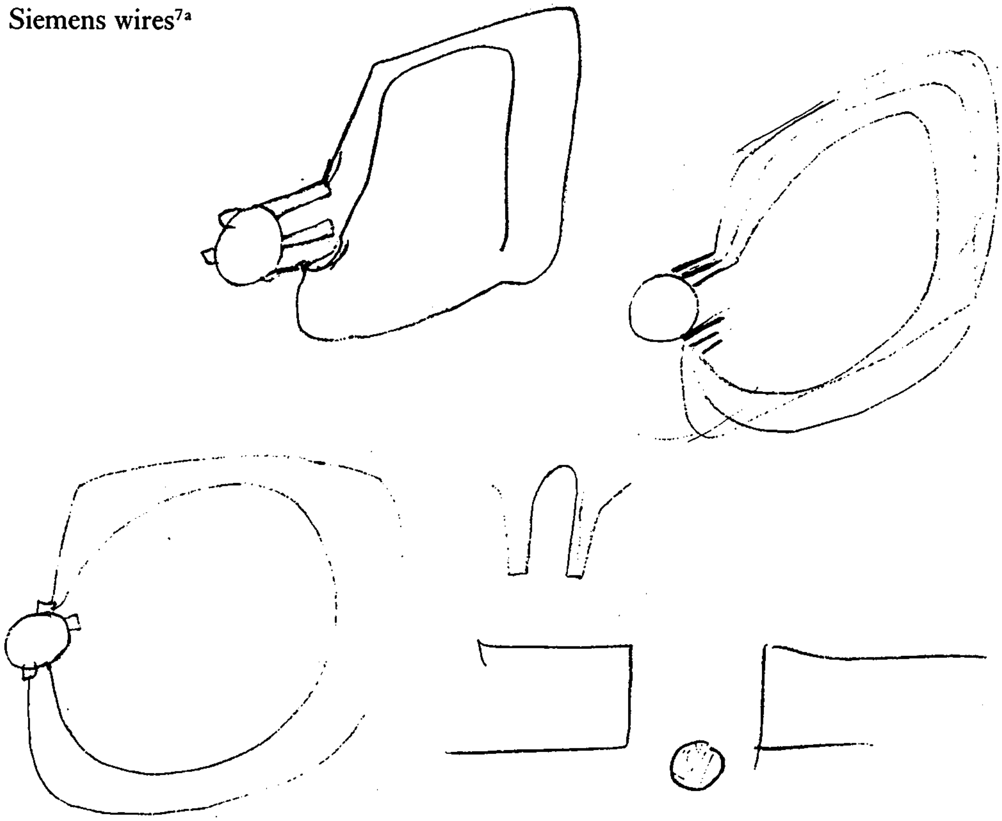


500	.002	cross section	
1000	.001	"	"

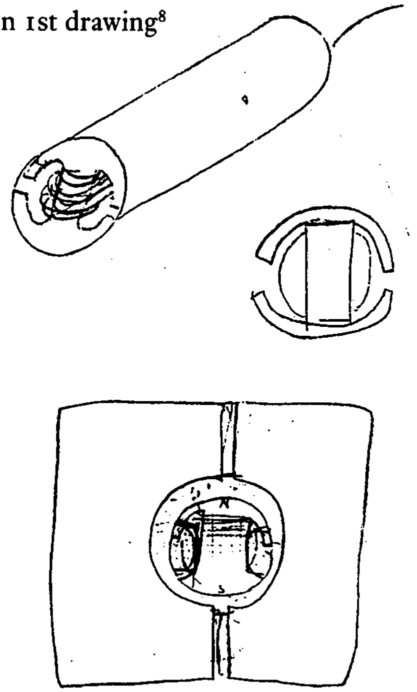
Gramme[6]



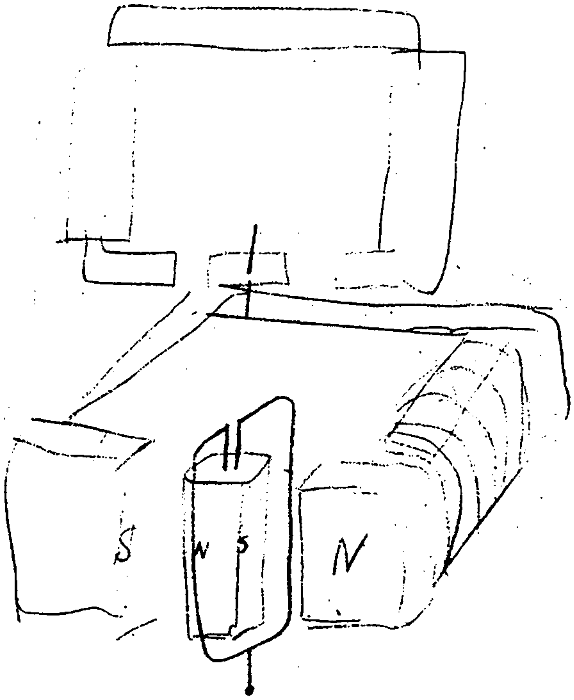
Siemens wires[7a]



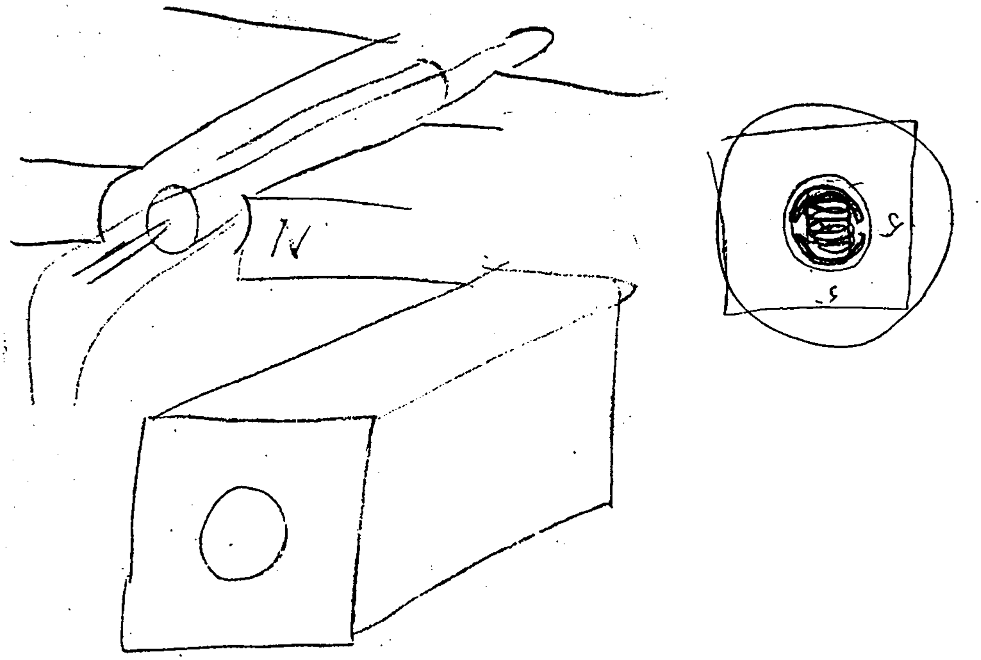
~~S~~Edison 1st drawing[8]



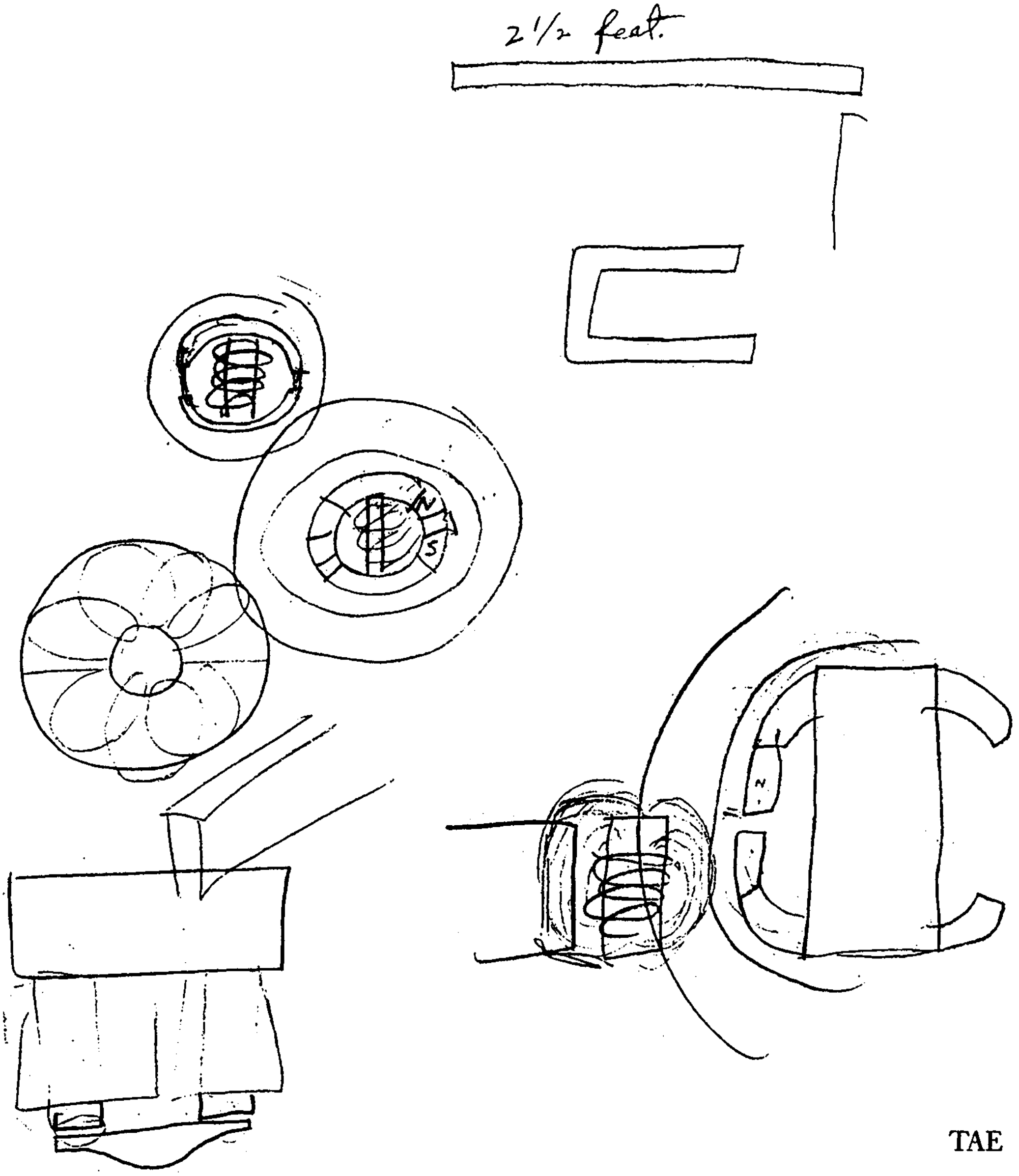
Siemens form of



Edison dynamo[c]



3 feet 4 inch[b]

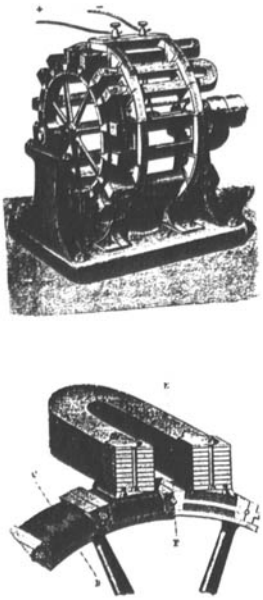


TAE

X, NjWOE, Lab., N-78-12-11:23, 27–57 (*TAEM* 29:690, 692–707). All drawings by Edison, text written by Francis Upton; document multiply signed and dated. One page of incomplete, canceled drawings omitted. [a]Obscured overwritten letters. [b]Text written by Edison. [c]Repeated as label for all following drawings.

1. The relation of this label to the drawings is uncertain. Edison's work on understanding and designing generators during the latter part of 1878 roughly followed the general pattern of the historical development of the field. Such work was necessary to attain competence, since

"to those who have not served an apprenticeship to the technicalities . . . the action of these machines is almost an unknown mystery" (Dredge 1882–85, 1:37). Several sketches here and in other entries reflect the prior practice that Edison was tracing and elaborating upon in an approximately chronological sequence. Having already considered disk armature designs related to the earliest of all generators—Faraday's—and having worked with Wallace's generator (a leading contemporary disk armature design), Edison explored designs with ring armatures (notably employed in designs by De Meritens and Gramme) and pole armatures (such as used by Lontin and Weston), and took up shuttle and drum armature types (identified with the work of Siemens and von Hefner-Alteneck) as well. He also reviewed a similar range of field-magnet configurations and considered many modifications. (On dynamo development generally, see Dredge 1882–85, King 1962c, and Prescott 1884.)



A De Meritens dynamo, and detail of its construction.

Neither the machine shown here nor the next designs (which show field magnets of the form used in many Siemens generators) have any clear resemblance to the various De Meritens generators, some of which had been introduced recently in France. Those were not dynamos, as they used permanent magnets for their fields. Moreover, they used ring armatures consisting of a number of segments. The drawing above has electromagnets providing the field and apparently a pole armature, with coils projecting radially from the armature's axis. In one widely discussed De Meritens design, each segment was made of fifty thin iron plates pressed together and capped with iron at both ends. These were then wound with insulated copper wire and mounted on a bronze wheel, with strips of copper between them to magnetically insulate them from each other. As the bronze wheel revolved each segment passed under one of the poles of a series of horseshoe magnets. According to contemporary reports, the machine could light three Jablochkoff candles for each horsepower used; other generators required one horsepower per lamp. Some Edison designs in Doc. 1621, with ring armatures and multipolar field magnets, are similar to major aspects of the De Meritens generators.

The label here probably indicates that the design shown had no commutator and thus would produce alternating current. The De Meritens high output was attributed to its armature design and to its having no commutator. According to an article clipped from the 18 October *English Mechanic* by Charles Batchelor, current was drawn instead through two springs placed against insulated rings on the armature shaft, which were themselves in contact with the windings. The resulting alternating currents could thus pass directly into the line without loss due to sparking in the commutator (see note 4). Also, pole armatures like that shown here were mostly associated at this time with generators that produced alternating current. Edison did not have access to a De Meritens dynamo but he had already borrowed a small Gramme from Princeton and had probably received the Siemens machine from William Wallace (see Doc. 1615). Dredge 1882–85, 1:185–204; Prescott 1879, 495–98; Sprague 1878a.

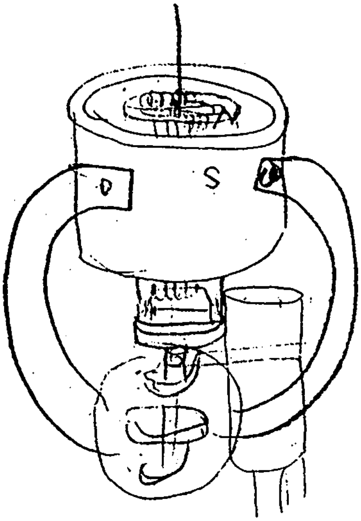
2. During his testimony in *Sawyer & Man v. Edison (U.S.)* (p. 3067 [*TAEM* 48:40]), Edison described a shop lamp as "one in which the current only had to be subdivided in a shop, and not over a large area,

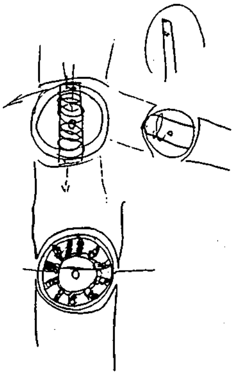
where a high resistance was not absolutely essential." He claimed that in January 1879 they experimented with carbon paper in a shop lamp similar to that shown in Fig. 2 of his U.S. Patent 224,329; the shop lamp sketch shown here resembles the design in Fig. 1 of the patent (see Doc. 1567 n. 1). Details of shop lamp designs from 9 January 1879 are in N-79-01-01:95–99 (*TAEM* 30:305–7).

3. This appears to be a design for dispensing with battery current in the Edison telephone set. The electromotograph receiver crank would also turn a small Gramme generator. A similar design is in N-79-03-20: 122, Lab. (*TAEM* 33:62).

4. The commutator of a generator is the contact point between the armature, where the current is created, and the outside circuit (which, in a dynamo, includes the field magnets). It automatically switches connections on the armature so the alternating current that is generated gets distributed as direct current. Commutators at this time were generally stationary wire brushes that picked up the current by pressing against the outside of a segmented copper circle on a rotating armature, where each segment was attached to a section of the armature wiring. They added to the expense of operating a dynamo, because sparking as each brush broke contact with each segment wasted electricity, inefficient contact wasted energy as heat, and brushes rubbing against the rotating commutator caused friction and wear. Excessive sparking quickly burned the commutator's parts, leading to costly, time-consuming repairs. Carefully adjusting pickup brushes relative to the armature's rotation could temporarily reduce or eliminate sparking, but each change in the dynamo's load altered the optimum position of the brushes. Alternating-current generators do not require commutators, which was one of the principal reasons generator designers in the 1870s had given considerable attention to alternating-current arc lighting systems (Thompson 1902, 78–84). However, because there was no motor that ran on alternating current, Edison did not consider it for his system.

Sketch labelled "Attempt at non-communtator The suggestion for a new telephone receiver."





Edison's first attempt at a non-commutator design.

Edison first drew a non-commutation device on 13 December. Other drawings of designs without commutators are in N-78-12-28:13, 19–29; N-78-12-20.1:3, 24–34, 37–45, 56–59, 64, 68; N-78-12-11:9; N-78-11-22:41–47; N-79-03-20:50–51, 77–82, 122; all Lab. (*TAEM* 30:8, 11–16, 117, 128–33, 134–39, 143–44, 147–48; 29:173–77, 683; 33:27, 39–42, 62).

5. It is the field magnet rather than the armature in the following drawing that follows the form typical of Siemens machines.

6. The relation of this label to the drawings is unclear; the designs share little if anything with Gramme's.

7. The wires shown could represent an earlier type of Siemens armature, the shuttle, but the multiple commutator bars at the hub indicate they are just a segment of a set of such loops that would form a cylinder. Siemens generators used the design of von Hefner-Alteneck, in which the wire of the armature was wrapped around the outside of a rotating drum and connected at each turn to contacts on the commutator, so the coil was continuous but each segment was individually connected to the commutator. It resembled the Gramme ring in this feature but it had no return segments inside the circumference of the armature, and had comparatively smaller diameter and greater rigidity, allowing a smaller gap between the armature and the field magnet poles. These machines were the first to produce so much current that the resulting heating became an operational problem. King 1962c, 370–74.

8. There are several sketches of this distinctive shape from the same day, and another on 21 December. It closely resembles a shuttle armature but the complete magnetic shielding of the wire coil dictates that this is a magnet design (rather than any kind of armature) either for a rotating central field magnet or for a magnetic core for an armature that would revolve around it. Edison adopted such a design for more extensive trial at the end of the year (see Doc. 1646 nn. 3–4). N-78-12-11:21, 47, 53–59, Lab. (*TAEM* 29:689, 702, 705–8).

-1628-

Notebook Entry: Electric Lighting

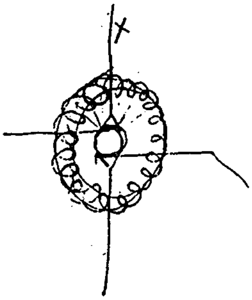
[Menlo Park,] Dec 18 1878

Gramme Machine

With small gramme, with Jamin magnet[1] a piece of Platinum wire was heated red—.01 thick & twenty two and ⅝ (22⅝)[a] inches long. 2.43 ohms The same can be done by eight (8) large cells of Condit & Hanson[2b]

In this machine Edison proposed an improvement: He claims that if Gramme would take off his armatures & cut out all the coil but the sections he uses,[3] by commutators; he would get a better effect seeing he would lessen his resistance[c] internally and he thinks get the same force[4] I made an experiment to try this by holding two pieces wire in shape of Y[c] over top and bottom thus dead short circuiting ⅔ of the coil.[5]

This device actually slows the speed. Not so good



Chas Batchelor

X, NjWOE, Batchelor, Cat. 1304:10 (*TAEM* 91:12). Written by Batchelor. Document multiply signed and dated. [a]"(22⅝)" written in left margin. [b]Followed by two centered horizontal lines. [c]Obscured overwritten letters.

1. Hand-powered Gramme generators for table-top demonstrations commonly had permanent instead of electromagnets. A compound magnet designed by the French physical scientist Jules Jamin, consisting of several thin magnetized steel strips laminated together and with its poles a little closer than in simple horseshoe magnets, was frequently employed. Dredge 1882–85, 1:156–57; King 1962c, 383.

2. Batchelor copied these observations from the laboratory notebook in which he had recorded them the same day. There he stated that the "Small Gramme Machine from Princeton heats a Platinum wire to dull red (only just see it)." The original entry includes his measurement of the platinum wire's resistance at 2.3 ohms. Batchelor also noted that 11 Condit & Hanson cells that were weak and "pretty well played out" had the same heating effect as the Gramme, but when refreshed would heat a 35½ inch wire with a resistance of 3.47 ohms. N-78-12-16:101, Lab. (*TAEM* 29:1126).

3. Batchelor meant those portions of the armature winding which cut the field magnets' lines of force at any given moment.

4. A similar provision was a significant feature of the Brush dynamo. See Doc. 1489 n. 4.

5. Short-circuiting of a portion of the coil is not the same as Edison's suggestion of opening the circuit for those portions.

-1629-

Draft to George Bliss

Menlo Park, N.J.,[a] Dec 19, 78

Reply[1]

McKenzie visited me sometime ago & in some way the subject of making a type writer adapted to stencils was brought up— I asked him why he didnt work it up— A Sun reporter happened to hear the conversation & made a note of it[2] I am not adapting the type writer for any such purpose I have nothing whatever to do with it[3] Very Truly

T A Edison

Df, NjWOE, DF (*TAEM* 18:360). Written by Stockton Griffin; letterhead of T. A. Edison. [a]"Menlo Park, N.J.," preprinted.

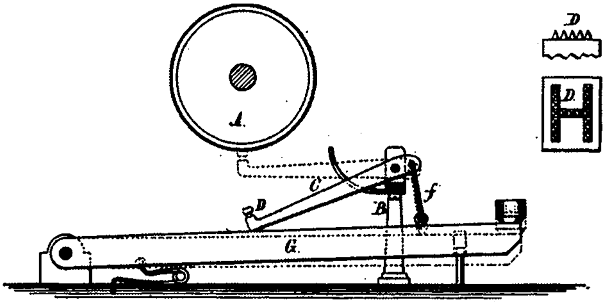
1. Edison apparently dictated this reply to a 6 December letter in which Bliss had complained about press reports that Edison was "adapting the Typewriter for the preparation of stencils so as to supercede the use of the electric pen. It is also stated that the business has been placed in the hands of Mr McKenzie. I can scarcely believe this to be possible and shall be glad to have you advise me what the facts are." DF (*TAEM* 18:359).

2. Edison is referring to an article in the *New York Sun* of 25 November which included a discussion of his efforts and those of James MacKenzie to develop a stencil typewriter. Although Edison had conceived such an idea in 1875, including it in his electric pen patents in England and other foreign countries (e.g., British Patent 3,762 [1875]), he had never perfected it, but instead

> chucked it into a dark closet, after getting into the telephone business, and there it remained until the other day, when my old friend J. U. Mackenzie came in with a similar idea in his head. I yanked the thing out of the closet, turned it over to him, and said: You want something to do. Work that up. He took it and cleared out. To-day he came back, and instead of dropping the thing, as I expected, he seems to have made a perfect success of it.

MacKenzie's instrument perforated a stencil using chisel point type "placed in a type-writer worked with the fingers like a pianoforte. Each written page may be placed upon a Gordon press or an electric pen press and as many copies worked off as wanted." The *Sun* reported that MacKenzie "regards the success of the stencil type writer as assured, and there is undoubtedly a fortune in store for its inventors." "The New Electric Lights," Cat. 1241, item 1021, Batchelor (*TAEM* 94:416).

3. In fact, Edison had acted to secure a U.S. patent. He made two sketches related to a "Perforating Type Writer" on 29 November, and John Ott's timesheet indicates that he spent the entire next day making "Type Wrighter Models." On 2 December, Lemuel Serrell received a model and draft patent specification for the typewriter; Edison executed the application two days later. The application was rejected and modified repeatedly, finally issuing in 1884 as U.S. Patent 295,990. NS-



Edison's design for a stencil typewriter in his December 1878 patent application (U.S. Patent 295,990) structurally resembles designs included in his foreign patents for the electric pen a few years earlier.

78-001, Lab. (*TAEM* 7:736); Ott's timesheet, Serrell to TAE, both DF (*TAEM* 17:824, 18:822).

In reply to Edison's assurance that he was not developing such a device, Bliss stated "I am glad you are not disposed to press the type writer adaptation for stencil work on the market, as it seems to me this could not be done without seriously interfering with the legitimate pen business. It is hard work to make a success of the pen trade with the least possible hindrance in the way." A year earlier, Bliss had looked forward to Edison developing just this combination. Bliss to TAE, 23 Dec. 1878, DF (*TAEM* 18:374); Doc. 1138.

-1630-

To George Gouraud

[Menlo Park,] Dec 19 [187]8

My Dear Gouraud

I suppose you are all out of all patience waiting for the new receiver—[1] The fact is I have had it working nicely and thought it was permanent and all right—but I learned differently as time went on and found they deteriorated That is, the chemicals used did not stand but lost their power— Now I am engaged in making them permanent and hope to have them all right soon— I cannot let them go until they are above criticism. Yrs Truly

T. A. [Edison][a] G[riffin]

L (letterpress copy), NjWOE, Lbk. 4:54 (*TAEM* 80:26). Written by Stockton Griffin. [a]Faint copy.

[1] Edison had written Gouraud on 18 November that he wanted "to do a little more work on the new receivers, they must be perfect when they leave my hands. I expect to send my nephew (Chas Edison) with them as he thoroughly understands the mechanical details. I cannot say definitely when he will go but it will be soon." Gouraud replied on 5 December that he hoped the receiver would arrive in time for William Barrett to use in a 30 December lecture in London and urged Edison to "Spare no means to this end. It will be a grand opportunity to bring the thing out." Lbk. 4:7 (*TAEM* 80:19); DF (*TAEM* 18:218).

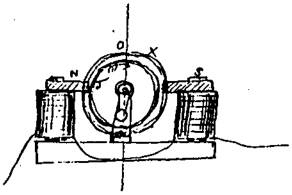
-1631-

Notebook Entry: Electric Lighting

[Menlo Park,] Dec 19th 1878

Magneto Electric Machines

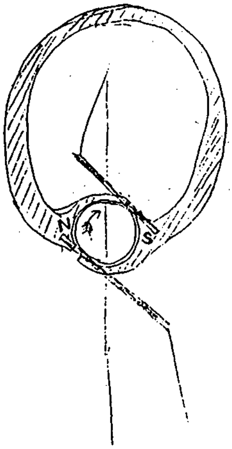
In a magneto Electric machine in which there is used a ring of iron for armature & being revolved at a great speed the poles (induced in the armatures are not stationery as has been supposed abut are carried round by the rotation so as to be strong across its opposite diameter so:—



X is a round ring of iron on a shaft placed between the poles of a magnet very close without touching now when the battery is on the magnet there is no magnetism at O but when the ring is revolved rapidly it makes a strong pole at O and also strengthens the pole in ring at J.

That[a] is: instead of the induced pole in magnetised ring remaining still it is carried round by rotation.[1][b]

Chas Batchelor



Charles Batchelor's 20 December sketch.

X, NjWOE, Batchelor, Cat. 1304:12 (*TAEM* 91:14). Written by Batchelor. [a]Preceded by two short horizontal lines. [b]Followed by centered horizontal line.

1. This distortion results from the interaction between the poles created in an armature by the field magnets and those induced by electric current flowing through it. In a notebook entry the next day, Batchelor considered the relationship between this phenomenon and commutation: "In gramme armature the pole is carried round in direction of revolution. So it ought to [be] made as in sketch with shoes to help it round." There is also a rough, undated notebook drawing of the axes formed by the poles when the armature is at rest and in motion. Thompson 1896, 71–77; N-78-11-22:19, 23, Lab. (*TAEM* 29:162, 164).

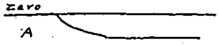
-1632-

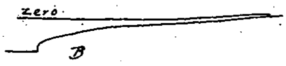
Notebook Entry: Electric Lighting

[Menlo Park,] Dec 19th 1878.

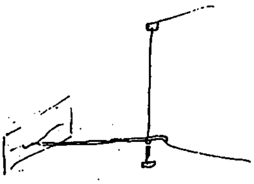
Heat in spirals[a]

A Platinum spiral is heated up to incandescence by battery





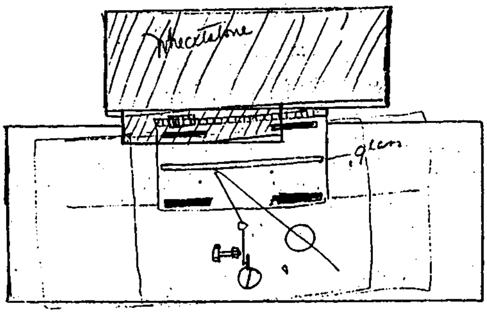
In taking heat it seems to increase in about the same ratio but in decreasing it loses very rapidly at first, and gradually tails out as in fig B. in order to determine these curves exactly, I made a platinum wire with lever on end and pointer about a foot long this, as the rod[b] expanded and contracted allowed the marking on smoked glass of the curves due to increase and decrease of the heat and it showed us that Fig A is proportional and B the cooling one very much out of proportion.[1]



This I think may be explained by the fact that when a body is heated to 900° Fahr it radiates at that rate and when at 2000° at 2000 rate so that when it begins to cool off it begins at the rate of 2000 and gradually comes to 100. It takes as long to radiate 100 at 100 temp as 1000 at 1000 temp.

Chas Batchelor.

X, NjWOE, Batchelor, Cat. 1304:13 (*TAEM* 91:15). Written by Batchelor. [a]Underlined twice. [b]Obscured overwritten letter.



Charles Batchelor's design for his instrument to record expansion and contraction of a wire during heating and cooling.

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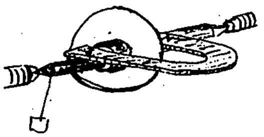
[1] The previous day, Batchelor had made several drawings of this instrument. Using a Wheatstone automatic telegraph receiver as a motor, he moved a vertical piece of smoked glass past the pointer attached to the platinum wire. N-78-11-28:39–43, Lab. (*TAEM* 29:39–41).

-1633-

Notebook Entry: Electric Lighting

[Menlo Park,] Dec 20th 1878.

Friction[1a]



Decrease by the lifting power of magnetism.[a] I took a shaft and put a wheel on the middle, and run it between centres.[2] I then took a given length of thread and weight; winding the thread on shaft and letting it go I timed its length of running with stop watch.[b]

First magnet used would just lift the weight of shaft when out.[b]

Second magnet was very strong being 4 together

Result

Shaft alone being mean of 10 times	7.75 sec.
First magnet close as possible to shaft mean of 10 times[c]	9.95[3]
Second magnet 1/16 from core: this lifted the shaft up in its bearings[d]	10.00
Second magnet ½ inch from core	11.00
Second magnet ¼ inch from core	11.25
Second magnet ⅛ from core at this place the shaft could either be lifted up to top of bearing or put to bottom[e]	20.75

Showing a gain over shaft alone in the proportion of 7.75 to 20.75[4]

Chas Batchelor

X, NjWOE, Batchelor, Cat. 1304:14 (*TAEM* 91:16). Written by Batchelor. [a]Underlined twice. [b]Followed by centered horizontal line. [c]"close . . . times" enclosed by braces. [d]"Second . . . bearings" enclosed by brace. [e]"Second . . . bottom" enclosed by brace.

1. These experiments are concerned with the problem of frictional energy loss in dynamos. Similar concerns were discussed by Edwin Houston and Elihu Thomson in their paper on the "Circumstances Influencing the Efficiency of Dynamo-Electric Machines" read before the 1 November meeting of the American Philosophical Society (Houston and Thomson 1879). They noted that mechanical energy was "expended in two ways, viz., 1st, In overcoming friction and the resistance of the air; and, 2nd, In moving the armature of the machine through the magentic field." In another set of notes from the same day Francis Upton explored the second problem. He also sketched what appear to be a commutator and a design "To prevent friction" similar to this one (N-78-12-16:121–22, 124–25, Lab. [*TAEM* 29:1136–38]; see also Doc. 1651 n. 16).

2. That is, center screws, which have a concave tip to hold the pointed end of a shaft, as in the diagram.

3. Batchelor was trying to find a way to reduce mechanical friction by placing "a magnet over the top of a shaft to lift it up and take the weight," hoping that this would allow it to "run longer with given amount of energy." He made ten trials of this experiment and the one above, recording the results the same day in a separate notebook. The values he reported there for the remaining experiments differ somewhat from those given here. He tried different magnets at different distances from the shaft. When he oiled the bearings and placed the magnet "1/16

inch away where you can push shaft to top or bottom," the wheel ran for "20 seconds or 2½ times the length of itself without magnet." N-78-12-20.1:5–9, Lab. (*TAEM* 30:118–20).

4. Based on their Franklin Institute tests (see note 1), Houston and Thomson had calculated average frictional losses at seventeen percent of the mechanical power required to drive a dynamo and considered this equivalent to thirty-three percent loss of electrical output. They noted that the Gramme dynamo was much more efficient, with mechanical loss of only seven percent.

-1634-

Notebook Entry: Electric Lighting

[Menlo Park, c. December 20, 1878][1]

Proportion of resistance[a]

in[b] a machine, where the ~~friction~~ loss of ~~curr~~ power is ½ in current & ½ in friction, [~~like~~?][c] or other factor ~~Quadrupling the power gives a gain~~ with a constant power, we do not gain anything by making the resistance of the machine ¼ of the external, but in a machine where the friction or other factors absorbs less power than the current there is a gain up to a certain point, when loss commences in a perfect machine th~~e~~is gain ~~gain is infinite by up to~~ increases without limit, but in a machine that absorbs more power in friction etc than the current there is a loss by making the external ¾ & internal ¼—

2nd Law

in any machine ~~m~~ no matter how ~~p~~ much power is lost by friction etc, Quadrupling the h.p. gives a gain in current, per h.p. ~~as~~ for the reason that doubling the speed in the case of friction on[2] doubles it while the current is quadrupled— This takes for granted that the commutators can take off the current as well at high as at low speeds[3][d]

X, NjWOE, Lab., N-79-03-20:7 (*TAEM* 33:5). [a]Written by Francis Upton. [b]Obscured overwritten letters. [c]Canceled. [d]Sentence written by Upton.

1. This undated entry precedes Francis Upton's notes on "magneto multiplier" machines and non-commutating generators, which were subjects of laboratory research from the end of November to late December (see Docs. 1627 and 1579). On 20 December, Batchelor experimented extensively with ways to reduce the loss of power in dynamos by the two causes identified here: mechanical friction and electrical resistance (Doc. 1633; see also Doc. 1628). The first notebook entry from these experiments contains a calculation showing one-half of the horsepower required to drive a dynamo being lost to mechanical and electrical friction. Upton labeled this "Horse power for magneto proportion of" (N-78-12-20.1:1, Lab. [*TAEM* 30:115]).

This entry follows two pages of Edison's calculations of the proportions of internal and external resistances for Wallace, Gramme, and Siemens dynamos. Edison also began, but did not finish, a note on the effects of doubling dynamo speeds. In another notebook from around this time, Upton made an extensive set of notes and calculations regarding the relationships between internal and external resistance, useful and uselesss work, and horsepower and dynamo speed, with comparisons between these different dynamos. N-79-03-20:4–6, N-78-12-04.1:11–37, both Lab. (*TAEM* 33:4–5; 29:568–81).

2. Edison probably meant "only."

3. In his other notebook (see note 1), Upton described the effect of doubling the horsepower on a Gramme dynamo: "2 Horse power put on a Gramme machine will give 1000 revolution the total resistance being 20 ohms, 10 in & 10 out. If the Horse Power is doubled i.e.—4 H.P and the total resistance is doubled i.e. 30 out 10 in = 40, the speed of the machine will increase to 3000 revolutions and double the work will be obtained." He concluded that in a "Perfect Gramme If the speed is doubled the electromotive force is doubled. If the internal resistance is halfed the E. F. is halfed, at the same time external increased half, total the same. If both at same time Elec-Force remains constant." N-78-12-04.1:21–25, Lab. (*TAEM* 29:573–75).

-1635-

From George Barker

Philadelphia Dec. 21, 1878.

My dear Edison:—

My big Gramme machine is burned out at the bobbin & has to go to Paris for repairs. The little one is too small to be of any use to you. The Princeton people have two, one for power the other by hand but the latter is about ten times the size of mine. Young can get the use of them for you.[1] You are welcome to mine but it is too small. The phonograph has not[a] come, as I expected from your telegram of Tuesday. I was exceedingly disappointed to have you order that one back, as I was just getting the hang of it.[2] You tie yourself up too close on your inventions. Will you send me the chalk cylinders for the motograph relay you promised? And if you can spare one, one of your new motorgraph receivers? Yours truly

George F. Barker.

⟨chalk cylinders & phonograph[3]⟩

ALS, NjWOE, DF (*TAEM* 16:526). [a]Interlined above.

1. Edison had wired Barker on 19 December, "Can you send me your small Gramme machine with permanent Jamin magnet for ten or 15 days." At the time Batchelor was conducting experiments with one they had borrowed from Princeton University (see Doc. 1628 n. 1). After receiving Barker's reply, Edison made a similar request of Henry Morton. This letter has not been found, but Morton answered that he would "gladly lend you any apparatus I had but unfortunately we have no

Gramme machine of any sort. I ordered one long ago through Barker but it was never sent." TAE to Barker, 19 Dec. 1878; Morton to TAE, 26 Dec. 1878; both DF (*TAEM* 17:1094, 1115).

2. Barker had borrowed a phonograph in November. On 16 December he asked Edison why William Carman had requested him to return it, since he had expected to have it for his lecture classes in January. Edison replied the following day (Tuesday), "Carman shipped you the wrong box. The instrument you have is a borrowed one and yours is here will ship tomorrow." DF (*TAEM* 18:1065, 16:523).

3. Barker thanked Edison on 19 January 1879 for sending him another phonograph, "not as elegant as the other, but it works quite as well." He also reminded Edison that he had not received the promised chalk cylinders. DF (*TAEM* 49:71).

-1636-

From William Wallace

Ansonia, Conn. Dec 21st 1878[a]

Dr Sir

I enclose an item from the N.Y. Sun of Dec 19th. I was very sorry to see it and cannot but feel that you do me a great injustice (not intentionally on your part I cannot believe) still the effect is the same greatly injuring the sale of my machine.[1] As an example a gentleman calld today who would have bought a machine only for the article mentioned which he said had caused him to change his mind & wait a while longer & see how Edison made out with new machine.

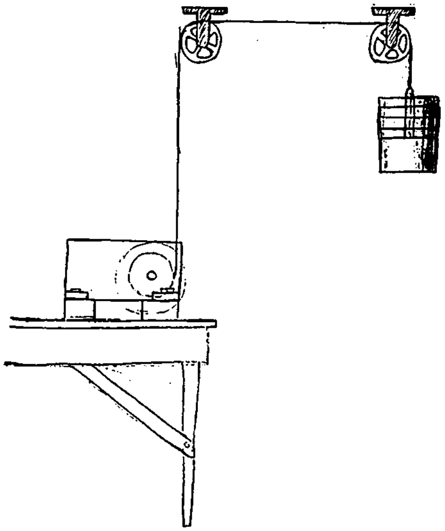
The machine you have was intended for the electric arc and is too intense. If you would[b] say just what you desire I could build one better suited to your purpose. You saw six lights of 2000 candle power each from one of those machines and I know that I have had 1500 candle power per horse power. I feel sure that more power will be required per candle power with incandescence carbon platinum or any other material than with the arc. Yours Respt'y

Wm Wallace G[2]

L, NjWOE, DF (*TAEM* 17:1103). Letterhead of Wallace & Sons. [a]"Ansonia, Conn." and "187" preprinted. [b]Interlined above.

1. Wallace enclosed part of "The Genie of Menlo Park," a *New York Sun* article about Edison's recent electric light research. The *Sun* quoted Edison as saying that he was satisfied with his lamp and had turned his attention to developing a suitable power supply:

> My point now is the generator. The Wallace machine gives me three lights, each equal to a gas light, to a one-horse power. I feel sure that I can get six with an improved machine. Probably I can get more. Now, to make my grand practical experiment here in lighting Menlo Park, I should have to use twenty or thirty Wallace



The weight-powered "Test machine for driving magnetos."

> machines. They would cost me from $30,000 to $40,000. They would be useless afterward, for I know that I can make a generator of double their power. So I shall postpone the experiment until I find the machine that will give the greatest amount of electricity per horse power. I am making many little generators of different forms. I propose to run them with weights, figured down to the fractions of a horse power, and shall take the machine that generates the most electricity.

The *Sun* clipping follows Wallace's letter in DF; the entire article is Cat. 1241, item 1066, Batchelor (*TAEM* 94:436).

On 17 December, the same day that the *Sun* article appeared, Charles Batchelor sketched a weight-drive for generators on which he wrote "Train of Gears Generator to run 600 Weight to fall 10 feet Size of drum about 3.85 in order to make 10 feet drop in 10 turns Pin on drum to connect circuit and on turning ten times opens again Large handle for winding Weight up again" (N-78-11-28:35, Lab. [*TAEM* 29:37]). Three days later he drew a "Test machine for driving magneto's" and gave it to George Jackson to build it (N-78-12-20.2:13, Lab. [*TAEM* 29:805]; Jackson's timesheet, DF [*TAEM* 17:856]). Related sketches from about this time are in N-78-12-15.1:37, N-78-12-16:102–3, and N-78-12-15.2:15, all Lab. (*TAEM* 29:960, 1127; 40:312).

2. Unidentified.

-1637-

To Norvin Green

Menlo Park N.J. Dec 23d 1878

Dear Sir.

It having been brought to my notice that you have expressed yourself as being displeased at the course I have taken regarding the new Telephone receiver I wish to say that it is barely possible there is a misapprehension in your mind which

I may be able to remove— My idea was that owing to the prospective litigation over the Magneto receiver, a new receiver without a magnet would be desirable property to insure the capital already invested, give better results, and remove all cause of contention. Premising that this instrument was needed immediately I proposed to bend my energy in that direction and put some of my young men to work experimenting. Of course this entails considerable expense and the terms I proposed was merely for reimbursement, because it is impossible to get up sufficient interest in my assistants without a promised reward,[1] their salary being small and the amount which would be received under the contract[2] too small to divide among several persons. Of course, (as I have already stated to Mr Twombly, Mr Walker and others) the experimenting can go on in the regular manner and the receiver when produced would be paid for as provided in the contract. If you do not require such an instrument now, it would of course be foolish to pay anything extra but simply wait until it is produced in the regular course. I was under the impression that the Company would like to have it as soon as possible so that they might be insured and also to prevent an accumulation of an enormous amount of apparatus which in time would on account of the improvement, not only be useless, but prove a loss to the Company many times greater than any sum paid for rushing the thing forward.

Trusting that this explanation will be satisfactory to you I am Very Truly

Thomas A Edison

LS, DSI-NMAH, WUTAE. Written by Stockton Griffin. A letterpress copy is in Lbk. 4:61 (*TAEM* 80:29).

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[1] Edison apparently made some arrangement with his nephew Charley, who was the principal experimenter on the new receiver. An account book entry that begins on 5 December is labeled "Chas Edison Contract." Ledger #3:335, Accts. (*TAEM* 87:146).

[2] That is, Edison's 31 May 1878 agreement with Western Union which required Edison to assign to the company any patents for new telephone inventions made by him before 1 January 1879. Miller (*TAEM* 28:1105).

-1638-

To Hamilton Twombly

Menlo Park NJ Dec 23d 1878

Dear Sir,

I have proposed to Kinney that if he will come here to perfect his instrument I will furnish him a part of my weekly allowance to do it.[1]

The reason why I did not write the letter promised was,

1st Dr Green wanted me to state the price I wanted before the thing was perfected This I would not do and am not compelled to under the contract because if it was accomplished easily I should ask a moderate compensation, but if it was very difficult then I should charge more. No one will set a price on an indefinite amount of labor—

2d Because Dr G has some relations with Mr Andrews who claims that an old contract he has, covers a portion of any autographic system I may devise these relations, or understandings, between Dr G & Mr A. are unknown to me, while I know exactly what Mr A claims from me, and as it is a matter between ourselves I could take care of him. His claim (about $250) was a venture by him in which I lost my time and he his money—

Any patents obtained would be assigned by Kinney and myself to the W.U. Telegraph Co and Andrews would have to sue me for his fraudulent claim, and not the W.U. Co. who would own the invention as against all comers. Are you satisfied that Kinney & I should go ahead in this way or will you add $25 per week to my allowance for Kinney, or how shall it be arranged?[2] Very Truly

T A Edison

P.S.= Kinney says in event of perfect success, he will take $2000. yearly during life of patent. If the thing is a success it will save the WU 3 to 400,000. yearly in wages if not a success the Co will lose several hundred dollars. T.A.E[a]

LS (letterpress copy), NjWOE, Lbk. 4:64 (*TAEM* 80:31). Written by Stockton Griffin. [a]Postscript written by Edison.

1. Patrick Kenny was apparently at the laboratory by 28 December. Timesheet, DF (*TAEM* 17:870).

2. Twombly replied the same day that he had discussed with Green

> the employment of Kinney, and he states that he is firmly of the opinion that until Mr Andrews has given up the contract which he has seen, he Mr A will prefer a claim upon any invention covered by said contract. He therefore would not be in favor of adding (25) twenty five dollars per week for the employment of Kinney until you have retired the contract, although he would not have any ob-

jection to a portion of the regular weekly allowance being applied for that purpose.

The President I know has not any understanding with Mr Andrews, but has discussed the matter with him, and Andrews has signified that he would not be unreasonable regarding the matter. [DF (*TAEM* 19:575)]

-1639-

From Grosvenor Lowrey

New York, Dec 23rd 1878[a]

My Dear Edison:

I am down to day for the first time.

The Executive Committee of the Light Company had a meeting at which, however, only Mr Edson and Mr Banker were present.

We had a very good natured laugh over their disappointment. at their visit. In addition to not finding you, they say that the general dilapidation, ruin and havoc of moving, caused the electric light to look very small, and that it looked rather as if you were getting ready to have an auction.[1]

The accounts of expenditure were brought up, and it appears that about $18 000 to $19 000 has been expended, as I understood, mostly upon buildings & permanent erections. Mr Banker was very nice about all this, and said that although the cost of buildings was much greater than they had been led to suppose was necessary, yet it was allright, of course, if it was actually necessary. He seemed, however, very desirous that he and I as trustees, in a certain sense, for the expenditure of the $25 000 should be able to answer for the details of these expenditures if, (as will be the case if we fail) we are asked by the subscribers any questions.

On the whole, I think it desirable that Mr Goddard, as Sec'y of the Company, should, with Mr Carman & Mr Griffin, go through all these matters and arrange all the vouchers, and put and keep the whole thing in exactly the right business form.[2] It is very desirable that the Board should always have somebody to refer to who will understand everything going on at the works.

I shall go South some day this week with my boys for a couple of weeks, & before going should like to get the Drexel Morgan agreement off my hands— I shall in a few minutes go downstairs to see them and enquire if the paper is satisfactory to them.

Please let me hear if it is satisfactory to you. Yours Very truly

G. P. Lowrey

LS, NjWOE, DF (*TAEM* 18:121). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted.

[1] Tracy Edson, James Banker, and Calvin Goddard had arranged to visit the laboratory on Friday, 20 December. Timesheets of two Menlo Park workers indicate that they had begun moving shop equipment to the new main building the preceding Saturday. Moving continued into the following week. Edson to TAE, 18 Dec. 1878; Charles Dean and Charles Flammer timesheets; both DF (*TAEM* 18:119; 17:841, 854).

[2] See Doc. 1562.

-1640-

From Tracy Edson

New York, Dec. 24th 1878[a]

My Dear Mr. Edison,

I have received a copy of your letter of 23d inst. to Dr. Green,[1] which would have been rendered unnecessary, if Mr. Banker & myself could have seen you when we were at your place on Friday last, as we were authorized to accept your proposition in relation to your proposed new "Receiver" as stated in your letter to me of 29th Nov. last,[2] with the understanding that said Receiver, when connected with your Carbon Transmitter by a Telegraphic conductor, shall constitute a practical speaking Telephone, which shall also not infringe any patent in existence not owned or controlled by the American Speaking Telephone Company. I presume this is what you intended, as it is essential to its value, and if you will write me to that effect, the matter may be considered closed, and the papers can be prepared at once—Very truly Yours

Tracy R. Edson

P.S. A "Merry Christmas" to you. Please come & see me when you come to the City again[b]

ALS, NjWOE, DF (*TAEM* 19:824). Letterhead of Gold & Stock Telegraph Co. [a]"New York," and "187" preprinted. [b]Postscript spanned by brace.

[1] Doc. 1637.

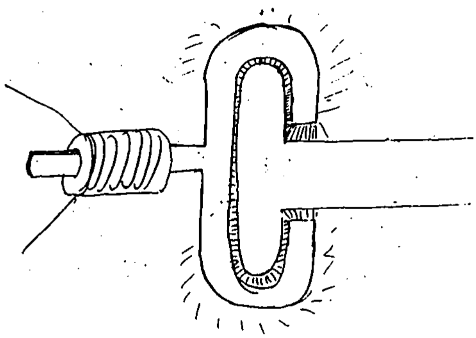
[2] Not found (see Doc. 1585).

-1641-

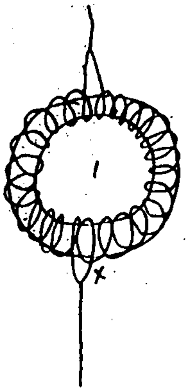
[Menlo Park,] Dec 25th 1878.

Notebook Entry: Electric Lighting

Magnets=

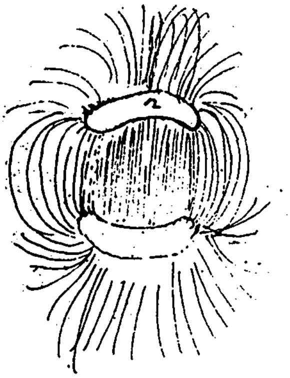


Armature entirely inside one pole. In this ~~sketch~~ experiment the lines of force are[a] cut all round the armature sharp showing that if a magneto were made on this principle it would be cutting the greatest (possibly) number of lines of force that can be done[1]



A ring of iron wound continuously with one wire round in one direction and the two ends connected together for one wire and a wire connected at X for the other.

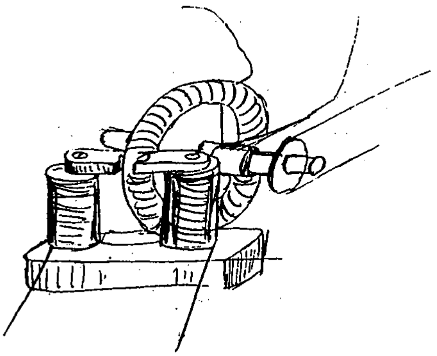
With a battery on the wire the lines of force appeared as in 2—



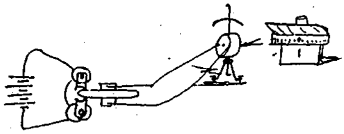
This should be same as the gGramme ring

Magneto Electric Generators

Made a generator with 3 layers 20 silk cov. wire on a 4 inch ring with field[b] magnets placed on sides so.

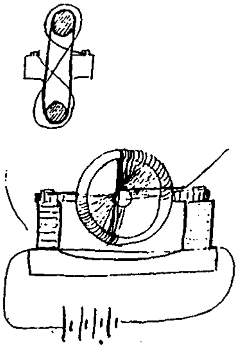


The wire was wound continuously in one direction for three layers and the two ends brought to copper rings on each side of the hub.



The magnets were connected to 4 cells battery and the commutator springs to a Thompson reflecting galvanometer; when the wheel was revolved rapidly in either direction, no current could be detected on the galv. because an equal and opposite current was set up in in each side of the same convolution neutralizing each other[2]

Chas Batchelor



Design for Charles Batchelor's 26 December ring armature experiment.

X, NjWOE, Batchelor, Cat. 1304:17 (*TAEM* 91:19). Written by Batchelor. Document multiply signed and dated. [a]Interlined above. [b]Obscured overwritten letter.

1. In this drawing the armature turns on a horizontal shaft (right) within the C-shaped pole of an electromagnet. This design is also found in Francis Upton's sketches of Gramme ring arrangements from around this time, including one with multiple armatures. Edison and Batchelor appear to have experimented on 28 and 30 December with other unipolar designs which failed to produce a current. N-79-03-20:106–9; N-78-12-16:171–73, 192, 194, 195, 203, both Lab. (*TAEM* 33:54–55; 29:1151, 1152, 1161, 1162, 1164).

2. The next day Batchelor tried an armature that was "wound in the shape of figure 8 and the ends brought each to a copper ring on the hub." He noted that "no current could be detected except the current due to induction on passing it in front of the poles." Three days later Upton recorded similar results and drew several sketches of the direc-

tion in which he thought current might be induced in such a winding. On 27 December, Batchelor used the three-layer and figure eight windings in another generator design but once again "no current could be detected." Cat. 1304:20–21, Batchelor (*TAEM* 91:22–23); N-78-12-16:183, Lab. (*TAEM* 29:1156).

-1642-

Telegrams: To/From Union Square Theatre

December 26, 1878[a]
Menlo Park, N.J.,[b] 6:11 PM

Ticket Office Union Square Theatre[1]

Please keep four Orchestra[c] seats for Saturday night[2] will call for them Answer

Thomas A Edison

NY 9 PM

Thomas A Edison

Will have seats at Box office for[c] you

E. H. Gouge[3]

L (telegrams), NjWOE, DF (*TAEM* 16:542). Letterhead of T. A. Edison. [a]Date from document, form altered. [b]"Menlo Park, N.J." preprinted. [c]Interlined above.

1. The theater was located at 56 E. 14th Street in New York. Wilson 1879, 1481.

2. The Union Square Theatre presented *The Banker's Daughter,* a romantic melodrama by Bronson Howard. The play had been staged under a different name in 1873 but premiered under the present title at the Union Square on 30 November 1878. An advertisement claimed that it was "produced with the finest scenery and appointments ever seen in New York in a modern play." The show became a hit and played until April. Edison and his wife probably saw the Saturday, 28 December, performance with Charles and Rosa Batchelor. *New York Herald,* 28 Dec. 1878, 1; Howard and Halline 1941, 84–85.

3. Edward Gouge was the theater's treasurer. Wilson 1879, 557.

-1643-

From Norvin Green

New York Decr. 26th 1878[a]

Dear sir:

In reply to yours of 23d instant,[1] I regret that my position in respect to the negotiation with you for an early production of a new Receiver, should have been communicated to you as an expression of displeasure with you. The contract between us appeared to me to make ample and proper provision, but I was quite willing, in addition to such provision, to pay a bonus that would cover the cost and compensation for the extraordinary effort for its early production. I was unwilling to add to the royalties for which the Gold and Stock Company would be responsible, and believed, as I now believe, that if you understood the situation thoroughly, you would not ask it. I am quite satisfied there never has been a dollar of profit to any proprietor operating the Telephone; and unless the competition is speedily reconciled and better prices obtained, there never will be.

The Gold and Stock Company are paying you a very handsome annuity for the use of what has never yet, and does not promise at an early period to pay them back any profit whatever. In this state of the case I did not consider it prudent to add materially to the burdens, in the form of rentals, royalties, &c, which the Gold and Stock Company is now bound to pay quarterly, and preferred that anything additional we should have to pay to what was provided in the contract should be paid up at once as a bonus. The subject was, however, referred to a Committee with power, with whom you will no doubt, be able to make terms.

I can not close this letter without referring to your note to Mr Twombly[2] concerning the Autograph invention, and your inferences that I had some relations with Mr Andrews which seemed to mean some partiality in favor of his claim upon it. I beg to assure you I have had no dealings whatever with Mr Andrews, but having been shown your agreement with him in writing, I could not deem it prudent to make any contract for an invention which he set up claim to, supported by what appear to be a written contract. I should be very glad to have that matter reconciled and would cheerfully recommend some expenditure in the development of whatever may be found valuable in an Autograph instrument.

I am, respectfully, and truly yours,

Norvin Green President

LS, NjWOE, DF (*TAEM* 16:543). Letterhead of Western Union Telegraph Co., President's Office. [a]"New York" and "187" preprinted.

1. Doc. 1637.
2. Doc. 1638.

-1644-

Notebook Entry: Electric Lighting

[Menlo Park,] Dec 27 1878[1]

1 Resistance of bobbin ⟨H R⟩[a]
2. Proportion of field magnet to bobbin ⟨~~W~~ H M⟩[a]

3. Exterior resistance ⟨W⟩[a]
4. Total heat[b] in machine ⟨H⟩[a]
5. Total heat in ~~field~~ outside ⟨W⟩[a]
6. Heat in field magnet due to close coiling ⟨H. M⟩[a]
7. Heat in ring bobbins due to coiling. cause. Small radiating surface Prevention Rotation and bringing air currents to the coils ⟨H. R⟩[a]
8. Heat by demagnetazation of the core ⟨H. R⟩[a]
9. Heat given off when quiescent & out of field ⟨H. R⟩[a]
10 Resistance of commutators ⟨C⟩[a]
11. Heat in field magnets due to the passage of variable magnets across ⟨H. M⟩[a]

TAE

X, NjWOE, Lab., N-78-12-16:135 (*TAEM* 29:1143). Written by Francis Upton; dated by Edison. [a]Written by Upton. [b]Interlined above.

1. This list appears to be Upton's effort to determine how the energy put into a generator is expended. The marginal letters following each numbered item seem to characterize the type of expenditure. Their meaning is uncertain, though "C" is probably current, "H" is probably heat, "M" is probably magnetism, "R" is probably resistance, and "W" is probably work. The entry is one of several made the same day in this notebook. It is preceded by two pages concerning electricity and heat and six pages of armature and field magnet designs. It is followed by a page of calculations of battery current.

-1645-

From George Gouraud

LONDON, 28 Dec 1878[a]

T. A. Edison Esq
Phonograph

I hand you herewith a statment of Professor Barrett's the significance of which you will be sure to appreciate. He tells me besides that he believes Nottage is making a large income from Exhibitions. He knows that his net receipts from Dublin alone were very considerable as after the initial Exhibitions (those following Barrett's Lecture) one firm paid for a long time £50 a week for the privilege of continuing the show. Besides Barrett's evidence of Nottage's policy in refusing sales of Phonographs I have numerous other instances in corroboration of the same. I am frequently asked where Phonographs can be bought, some for private use some for export and in several instances where I have referred them to Nottage I have heard that they were unable to buy them on any terms.[1] Now this seems to me a great outrage and a great violation of not only the spirit but the letter of your Contract and I can only say to you that if you will place me in a proper position so to do—and it must obviously be as an interested party—I will make it my business to reform this thing. We have evidence enough to enable us to cancel the Contract and take the whole thing out of his hands but before accepting such an alternative I feel sure that I could accomplish a compromise by which the advanced Royalties already paid you would be soon covered—if indeed they have not been long since—by Exhibitions and a further income to you early follow. This matter is seemingly well worth your attention and need take no more of your own time and thought than to put me (or somebody else if you like) in a suitable position to act in the premises.[2]

In this connection, referring to your offer of some time since to sell me a certain interest in your English Phonograph Royalties I do not feel under all the circumstances, justified in accepting it and submit for your consideration whether such services as I can perform in your behalf would not of themselves justify a compensation in the form of a share of the results. But should this not meet your views, I nevertheless place my services at your disposal in any manner you may indicate so far as may be practicable for me to carry out.

Geo. E Gouraud

ENCLOSURE[b]

Memo. of Conversation ~~dictated~~ of Prof. W F. Barrett with Sterescopic Co. Cheapside London, 28 Dec/78—& dictated by him to me Thomas Butler,[3] and in the presence of Col. Gouraud—[c]

I have just come from the Stereoscopic Co. having asked them to let me have a phonograph for my lecture on Monday evening— They offered me the last one that Edison sent over, but did not think they could supply one with a clockwork instrument— I told them I wanted one for my lecture at Hull and Manchester and proposed purchasing one from them according to an order I sent them some time ago—They shewed me several that they had in stock just come from the makers, the price of which was ten guineas—hand machines,[4] but they declined to let me have one and on my asking why, they said they required a written guarantee that the instrument should not be used for public exhibition, or if so used, should be used out of Great Britain and Ireland. I then said, "Do you positively decline to let me purchase one of your instruments for my lectures?" They said "Yes; on any conditions, we have not one now to spare— The first orders that have to be supplied are those taken at the Crystal Palace" I said, "Why are you so slow in making them? There is an immense demand now for them all over the Country as I know from enquiries addressed to me personally and what I hear from friends." They replied "We cannot get them made quick enough. Mr Blakey[5] of the British Telegraph Coy. having broken his contract and we think of bringing an action against him" I said, "Why not go to Elliot[6] or some large firm who could turn you out the thing quickly." The said "We have spoken to several— I remarked that as I was lecturing on Monday on Mr Edison's inventions I was anxious to shew his discoveries in their most perfect form; hence should be glad if they would enable me to do him all the justice they could—as doubtless they had made a good thing out of his phonograph and felt sure they would oblige me— They replied "It is Mr Edison that has made money out of us, not we out of him"—but they admitted having been wonderfully successful in Dublin in Exhibiting the instrument after it had been shewn at the British Association at my request.

LS, NjWOE, DF (*TAEM* 19:336). Written by John Kingsbury. Note form of George Gouraud; note form is electric pen copy. [a]"LONDON," and "1878" preprinted. [b]Enclosure is a D written by Thomas Butler. [c]Followed by a centered horizontal line.

1. On 1 December, Barrett had written Edison that the London Stereoscopic & Photographic Co. "have as yet supplied no phonographs to the public and though I have long since ordered one, I fear there is little chance of one being ready for my use" in lectures scheduled for 30 December and early January. He enclosed two letters that the Stereoscopic Co. "sent to a friend of mine, which will show that they are trying to secure the Exhibition at high rates as long as possible & hence no doubt their reluctance to sell the instrument." Barrett also stated that the Stereoscopic Co. had objected to his efforts to buy a French-made phonograph and he asked Edison if it would be possible to ship an instrument from the United States instead. Barrett to TAE, 1 Dec. 1878; London Stereoscopic & Photographic Co. to Rev. C. J. Ludenbill, 18 Oct. 1878; both DF (*TAEM* 19:323–27).

2. On 28 January, Edison wrote Puskas to ask if he would have any objection to giving Gouraud a power of attorney, but three days later he wrote again to acknowledge receipt of Puskas's £200 check in regard to the British phonograph, adding that this "materially alters the question regarding a power of Atty for Gouraud to look after the Stereoscopic Co. It does not now appear to be necessary." TAE to Puskas, 28 and 31 Jan. 1879, TP.

3. Thomas Butler was Gouraud's secretary for two years until the end of 1878 or early 1879. He subsequently became an officer in several Edison companies. Butler to TAE, 22 Dec. 1884, DF (*TAEM* 71:59); McDonald 1962, 15–16; *TAEM-G3,* s.v. "Butler, Thomas."

4. What may be one of these machines is pictured in Chew 1981, 6.

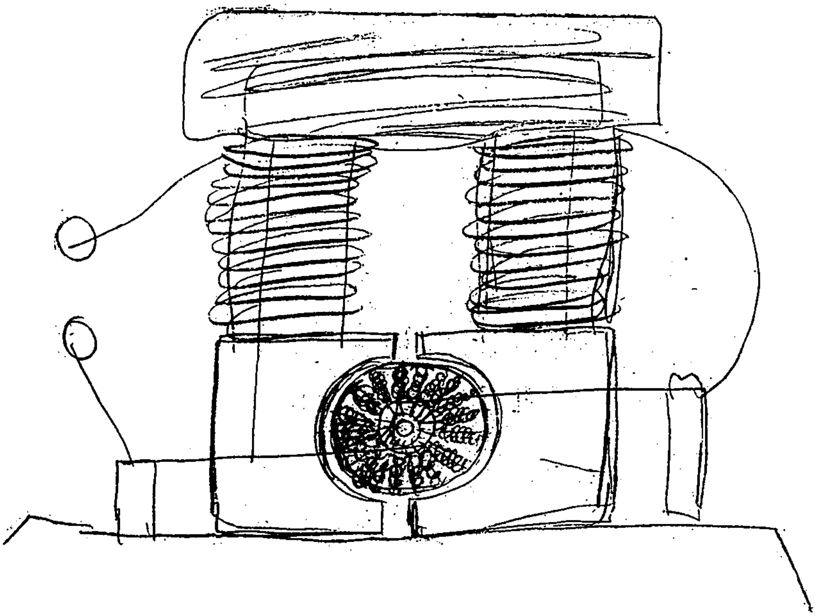
5. Neither Blakey nor the British Telegraph Co. has been identified; he may have been connected with the firm Blakey and Emmott (see Doc. 1511).

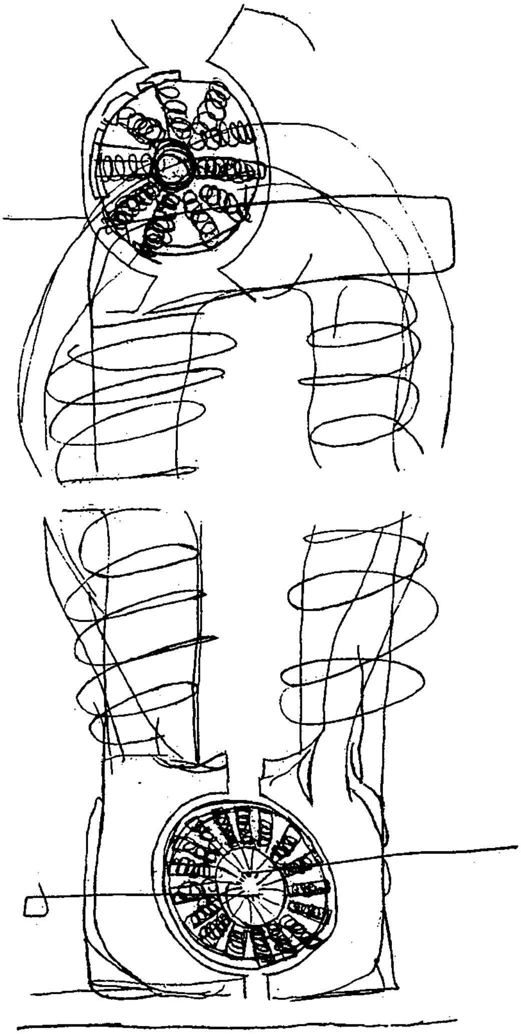
6. Elliott Bros., an instrument shop on the Strand in London. "1873 Catalogue of Electrical Test Instruments," *Catalogues, Electrical and Telegraph Instruments,* Library, NjWOE.

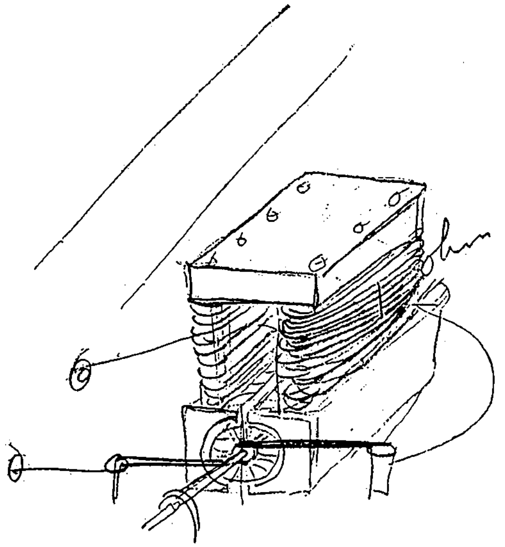
-1646-

[Menlo Park,] Dec 30 1878

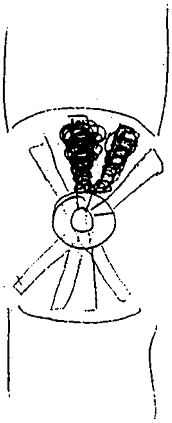
Notebook Entry: Electric Lighting



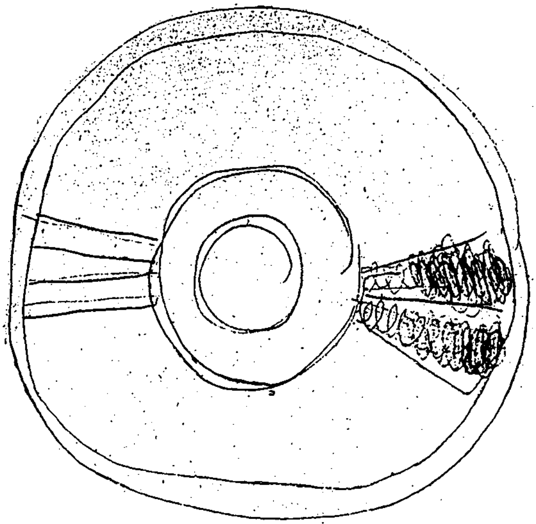




2 ohms[1]



Armature 5×9[a]



New Magneto Mach[2b]
Armature Cylinder

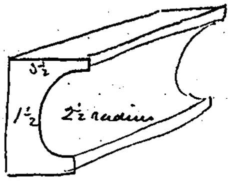
9 in long
5 in ~~thick~~ Diameter
¼ in thick[c]

Hub for same

9 in long
2 in thick
round solid[c]

Magnet Heads

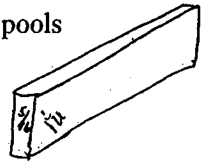
2½ radius
1½ thick
3½ broad
9 in long[c]



Cores for Armature Spools

pattern

1¼ in deep (long)
5/16 in thick
wide



Pitch of thread 10[c]
Wheel (driving)

Diam—9.61 in
Pitch " 9.55 in
Width ⅝ in
hole in hub 1 in
Six spokes
300 teeth (spiral cut)[c]

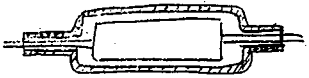
Armatures for same

Edison Armature[c]
Siemens Armature[c]
Gramme Armature[c]
Siemens Armature with stationery magnet[c]

Edisons Magneto Electric Mach.[3c]

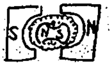
1 Commutator finely divided[c]

2 Armature must be made to revolve round a stationery core so[4d]



3 The stationery core[e] must be wound with wire and put in circuit with feild magnets thus putting part of feild in most concentrated part[c]

4 The armature & poles will then stand thus:—



so that we throw loops through a[e]very concentrated field[c]

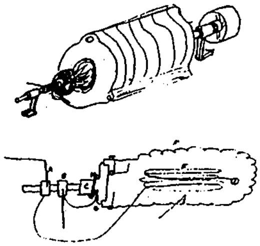
TAE Chas Batchelor

X, NjWOE, Lab., N-78-12-16:212 (*TAEM* 29:1169). Document multiply signed and dated. [a]Written by Batchelor; followed by centered horizontal line. [b]Rest of document written by Batchelor. [c]Followed by centered horizontal line. [d]Drawing followed by centered horizontal line. [e]Obscured overwritten letters.

1. The initial drawings in this entry show polar armature generators rather like those of Lontin, but apparently with cores of rectangular rather than circular cross-section for the poles. Dredge 1882–85, 1: 173–78.

2. Nothing further is known of this design. It is a small experimental generator whose field magnets are similar to those used by Henry Wilde, Charles Wheatstone, and Werner Siemens in the mid-1860s. King 1962c, 375–79.

3. The following four points specify the internal arrangement of a generator related to a machine under construction as the new year began. George Jackson and Thomas Logan recorded work on a new dynamo in their timesheets for 30 December (DF [*TAEM* 17:869, 872]). On 2 January 1879, Batchelor noted that they had "begun to make a



Charles Batchelor's 2 January 1879 drawing of Edison's new magneto design.

practical working machine after a few weeks hard study on magneto electric principles" and the design he sketched corresponds in several ways to the one here (Cat. 1304:25, Batchelor [*TAEM* 91:27]). This design, however, calls for an external field magnet as well as a magnetic core inside the armature, while the machine Batchelor discussed was encased in an iron shell without external magnets. Edison's sketch in a 29 December notebook entry labeled "Edison dynamo" presumably represents a generator with the same internal structure but shows the iron shell arrangement instead of external field magnets (N-78-12-11:61, Lab. [*TAEM* 29:709]).

4. The arrangement specified here is a drum armature with a stationary magnet core as mentioned earlier in the entry. Soon after the introduction of von Hefner-Alteneck's drum armature principle, Siemens dynamos were built with hollow instead of solid drums and a stationary iron core, but not an electromagnet as Edison specified. King 1962c, 374.

-1647-

From Calvin Goddard

New York, Decem 31st 1878[a]

Dear Sir:

I have this morning had an interview with Dr Soulages[1] and learn from him that all the large machines are reversing machines, but that each large machine is accompanied by a smaller one (two & ½ horse power) of continuous current.[2]

Dr Soulage does not seem to recognize Mr Latham's authority to make any arrangements such as that proposed & says he could not carry out his wishes in the matter without first obtaining the consent of his Company in Paris. He does not think they would be willing to loan a machine as proposed by Mr Latham, but thinks they would consent to allow him to sell us one of the small continuous current machines now here, separate from the large reversing machine which it accompanies— If we desire he will telegraph to Paris for authority The cost of the small machine will be 2000 francs with I presume the duties added.

Please let me know at once what your wishes are and I will act accordingly—[3] Yours truly

C. Goddard Secy

ALS, NjWOE, DF (*TAEM* 18:128). Letterhead of Edison Electric Light Co. [a]"New York," and "187" preprinted.

1. Little is known of C. C. Soulages. Puskas identified him as Cornelius Herz's partner and warned Edison to "beware" and to give him no information about Edison's light. On 27 December, Lowrey wired Edison that "If Doctor Soulage calls about Gramme machine refer him to Fabbri. Dont let him see light." At about this time Herz proposed that he and Edison "overlook past unpleasantness" and form an electric light

partnership with Milton Latham and Soulages. Puskas to TAE, 29 Oct. 1878; Lowrey to TAE, 27 Dec. 1878; Herz to TAE, 25 Dec. 1878, all DF (*TAEM* 18:175, 126, 246).

2. Gramme alternating current dynamos had a separate direct current generator for the field magnets. Prescott 1879, 482.

3. Stockton Griffin indicated on the back of this letter that a reply was sent the same day stating that Edison "Didnt want one of small machines if couldnt get it as proposed by Mr L." Edison borrowed a Gramme dynamo anyway and paid duties of 40 dollars on a machine that was shipped to him on 7 January. Soulages asked for it back the following May, noting that Edison had kept it an unexpectedly long time. Edison then offered to buy the generator but apparently was obliged to return it. Goddard to TAE, 7 Jan. and 5 May 1879; Soulages to TAE and Soulages to Goddard, 4 May 1879; TAE to Goddard, 5 May 1879; all DF (*TAEM* 50:206–7, 255–57).

-1648-

From Grosvenor Lowrey

New York, Dec 31st, 1878[a]

My Dear Edison:

I am going South tomorrow for a few days. I expect to be back within ten days.

Enclosed is a copy of a letter just written by me to Col Gouraud, which was first shown to Morgan and Fabbri and approved by them.

I think you should write to Puskas inviting him to express his views as to what interest with Drexel Morgan & Co, they to have control[b] would satisfy him, and I think you should begin the letter by saying that finding it would be necessary to write to him at some length and being entirely engrossed with the light itself, you had given that matter the go by for the present but that now it will soon come up again & must be disposed of—[1]

I think the European interest must be looked to for some contribution in money, if that should be necessary, towards the experiments here. It is rather an indefinite thing to talk about & therefore, as yet, I have not spoken to D.M. & Co on the subject, although I did intimate to Fabbri, by a message sent him while I was sick, that when we come to deal with the Continent I thought I should ask them to say whether, under proper restrictions, they would be willing to agree to furnish some money for experiments here, after the present fund has given out, if that should ever occur.

I think in writing Puskas you ought to ask him whether he would feel disposed to take the risk of advancing some given sum, and you ought to make it large enough to cover chances— It is a pretty difficult thing to ask a man to agree to, because every one likes to reserve to himself in matters of this sort the liberty of judging, from day to day, whether any further investment is worth while. I do not exactly know how we could expect anybody to bind himself for a definite sum, but if Puskas would be willing to put up $25 000 to $50,000 to be drawn for equally with the money which is now being used I should then say that nobody ought to interfere with his having the full swing: But even[c] if he is willing to do that, (while I have not the slightest expectation that D.M. & Co would agree to furnish that or any other specific sum) I think if the showing for final success[d] was fair you might reasonably look to DM & Co for as much help as that in the future, if they had the arrangement for the Continent.

You must manage this correspondence with Puskas yourself, for, you see, leaving all other considerations aside, I could not undertake to push aside an arrangement with him, which might give you the requisite funds, when I am not able to offer you in its place an equally positive assurance from D.M & Co that they would furnish a similar amount; and this, notwithstanding I believe, that[e] without any agreement in advance[f] with them, you would get more financial and other support in the stress which I am now looking forward to, than you will from Puskas and his friends even with any[e] positive promises fully performed, which they are likely to make.[g]

I hope you will keep well and will have that good fortune which high merit and perseverance deserve. Truly Yours

G. P. Lowrey

ENCLOSURE[h]

New York, Dec 31st 1878[i]

Dear Sir

I am again at my office after a disability of about three weeks, and I intend going to-morrow for a trip to the South for a little recreation and relief.

In the meantime I have not seen Mr. Edison since the receipt of your letter referring to the matter of fixing your interest in the English electric light business.

When he gave me the power of attorney he made reference to the fact that you had been representing him in other matters and that there had been some communication between you in respect to electric light. It was only after reading your correspondence that I saw how active you had been in the matter. In fact we were all so much engrossed, here, in trying to get a light made that not much thought has, as yet, been given to the secondary question of how it is to be disposed of.

The object of my taking a power of attorney from Mr Edison was to facilitate negotiations which I was endeavoring to make for him with a banking house, here, to whom he should be able to look, at all times, without the necessity of taking any trouble himself about his foreign affairs. I finally perfected an arrangement between him and Drexel, Morgan & Co, the terms of which are all agreed upon but which has not yet been signed. Mr. Edison has always stipulated that whenever Drexel, Morgan & Co take the matter up they shall put themselves in relation with you, and, so far as is possible, make use of your valuable services and secure to you a suitable participation in the profits. Nothing more definite has ever been said, and my idea has always been that that would be the subject of a negotiation between you and them upon fair business principles. They have agreed with Edison to advance certain requisite moneys and to use their best efforts and avail of all accessible means to sell the electric light for the best price and on the most favorable terms—in short, to work the thing up to the best possible advantage, dividing the net product between themselves and Edison in a proportion agreed upon— In other words, they have made themselves partners with Mr Edison in this business, and that I consider is a great gain achieved for him. They wished at first to be purchasers, but I declined, on his behalf, and said that I would furnish them the best inventor who would undertake to make the best light, and he would be a worthy partner, in such a business, of the best banking house, whoever it might be, and would be entitled to require that they should have no interest separate from his own. Whatever participation you have will come equally from Edison and from them—in other words, it will be a charge upon the joint account.

I shall not see Edison for ten days at least and in the meantime I think it would be useful to your own interests and also to Edison & D.M & Co., if you would write me your views and say what you think ought to be allowed to you in view of service already rendered, and what further should be allowed in view of such services as you are able to render to them. Of course, I am now talking very much in the dark but I can assure you, and I beg you to receive it with full credit, that after conversation with Drexel, Morgan & Co. upon this matter I feel entirely satisfied that they intend to meet you in a fair, and even liberal, spirit. They cannot, of course, at the present time foresee what will be their course in dealing with this business, nor be able to foresee how much or how little benefit, on the whole, is to be derived from anything which you have already done or which you may be in a situation hereafter to do. Of course they do not feel that necessity for help in England which they might feel if they were not very well represented there in their regular connections. If you will write me freely upon this subject I will lay everything you say, in a fair way, before them, and that will be the proper beginning or basis of the necessary communication between you and them.

I should not write now, unprepared as I am, except that any longer lapse of time without an answer to your letter would be somewhat less than courtesy. Very truly yours

LS, NjWOE, DF (*TAEM* 18:250). Letterhead of Porter, Lowrey, Soren & Stone, Attorneys & Counsellors at Law. [a]"New York," and "187" preprinted. [b]"interest . . . control" interlined above by Lowrey. [c]Interlined. [d]"for final success" interlined above by Lowrey. [e]Interlined above by Lowrey. [f]"in advance" interlined above by Lowrey. [g]"fully . . . make" interlined above by Lowrey. [h]Enclosure is an L (copy); letterhead of Porter, Lowrey, Soren & Stone, Attorneys at Law. [i]"New York," and "187" preprinted.

1. Edison wrote Puskas on 3 January 1879 that he was

> sorry we cannot carry out the negotiations with Drexel Morgan & Co as foreshadowed in my Cable telegram of the 3d Ult. [Doc. 1596.] If you still feel disinclined to enter into such negotiations you must without delay make preparations to have parties there furnish some money for experimental purposes. The fund I have here is being rapidly exhausted, as it is very expensive experimenting. I bought last week $3000 worth of Copper rods alone, and it will require $18 000 worth of Copper to light the whole of Menlo Park ½ mile radius. It is also essential that Serrell should have at least $3000 in hand. A second set of patents on the Continent ought to have been taken out over a month ago but which has been neglected owing to a lack of funds.
>
> Please write me immediately if you can arrange so that your parties shall contribute some aid in experimenting and how much. [TP]

-1649-

Agreement with Drexel, Morgan and Co., Egisto Fabbri, and Grosvenor Lowrey

[New York,] December 31, 1878[1a]

Agreement entered into this thirty first[b] day of December[c] one thousand eight hundred and seventy eight, between Thomas Alva Edison, of Menlo Park in the State of New Jersey, party of the first part; Drexel, Morgan and Company, Bankers, of the City of New York, party of the second part; and Egisto P. Fabbri and Grosvenor P. Lowrey, hereinafter called the Trustees, parties of the third part:[d]

Witnesseth:[d]

Whereas the said Edison is the inventor of certain means for the development of electric currents and the application of the same to uses of illumination, power and heating, (which inventions are more particularly described in a certain application for letters patent under the great seal of the United Kingdom of Great Britain and Ireland, filed in the Patent Office at London on or about the day of October, 1878;)[2] and is prosecuting studies and experiments with a view to the making of other inventions relating to the same general subject; and is desirous of securing the aid and co-operation of said Drexel, Morgan and Company in obtaining similar letters patent for such inventions from time to time as they may be made, and in the financial management, exhibition, and bringing out and disposition of all such inventions in Great Britain and Ireland, the Channel Islands, the Isle of Man and such other portions of British dominions as are or may be included in such letters patent; and is willing to give Drexel, Morgan and Company sole control of the same, and to allow them to retain as their compensation one half of all net proceeds, benefits or emoluments which may be obtained by them upon any and all sales or other disposition thereof:[d]

And Whereas Drexel, Morgan and Company are willing to undertake such financial management and control of Edison's said inventions in Great Britain and Ireland, to be exercised whenever they shall be developed to a practical success suitable in their opinion to justify offering them for general use or sale; and, in the meantime, confiding in the skill and ability of said Edison, are willing to provide him the requisite means for obtaining and defending such letters patent, and for exhibiting said inventions on a proper scale, whenever in their judgment such an exhibition is desirable.[d]

And Whereas it is important that Drexel, Morgan and Company should be in a position of absolute security at all times, as to their ability to carry out all such engagements as they may make in the premises, against the revocation by death or otherwise of any power of attorney which might be given them by the said Edison, and for this object it is desirable to place the title to all said inventions made or to be made, and all letters patent which may be obtained therefor in two persons, or the survivor of them, subject to the trusts and conditions herein stated.[d]

And Whereas the Trustees, being requested by both the other parties, are willing to serve for this object.[d]

Now therefore it is agreed as follows:

First: Drexel, Morgan and Company hereby agree to assume the financial management of the said inventions and all of them in Great Britain and Ireland, and all the other places above recited or referred to. To give their best efforts and employ the best means and agencies accessible to them to obtain for such inventions or the right to use the same the best price and most favorable terms: To reimburse the said Edison all sums heretofore paid by him on account of the application for letters patent above referred to, not exceeding[e] One Thousand —(1000)—[f] dollars: To assume and pay all further charges incurred or necessary to be incurred in respect to securing or defending letters patent for any invention relating to the general subject matter above described which may at any time hereafter be made by Edison, and generally to aid him in all suitable ways and by all necessary advances, during the period contemplated by this agreement, in obtaining the legal monopoly in said countries to use such inventions, and in exhibiting and disposing of the same to the best advantage.[d]

Second: The said Edison agrees to transfer by an instrument of equal date herewith all the right, title and interest in his said inventions already made, to Egisto P. Fabbri and Grosvenor P. Lowrey as Trustees, upon the following trusts and conditions: First, to hold the same for the object and purposes of this contract, and from time to time by suitable act and deed to assign the same or any part thereof or privilege thereunder to such person or persons and in such manner as may be directed or appointed by Drexel, Morgan and Company: And in case Drexel, Morgan and Company shall have failed to dispose of the principal or controlling invention (being that upon which application for letters patent has been made as above stated) within three years from the first day of July, one thousand eight hundred and seventy nine, then upon demand in writing of Edison, served upon them at any time within six months from the expiration of such period, to reconvey the same to him subject to such outstanding licenses or partial or absolute assignments as may in the meantime have been made in good faith under a direction or appointment by Drexel, Morgan and Company, but otherwise free and clear of all claim and demands on the part of said Trustees or any persons claiming by, through, or under them: It being the purpose of this provision to give Drexel, Morgan and Company, for the period of three years from the first day of July, one thousand eight hundred and seventy nine, absolute power to dispose of, and assure a good title, to, said inventions or any of them, upon such terms, at such times, and in such manner as they may deem best for their joint interest with Edison herein created; and, after the expiration of that period, to give to the said Edison, at any time within the six months above mentioned, and under the conditions above stated, the right to resume exclusive control over the management and disposition of all inventions remaining undisposed of; and thereby to terminate the power and interest of Drexel, Morgan and Company under this contract.[d]

Third:[g] The said Edison hereby assigns, transfers, and sets over to the Trustees, upon the trusts herein provided, all other inventions or improvements, made or to be made by him within the period of five (5) years ending January first, one thousand eight hundred and eighty four, relating to the subject above described, to be held upon the like trusts and conditions; and agrees from time to time, as they are sufficiently complete for that purpose, to make to the Trustees special assignments of each separate invention, and to make prompt application for letters patent upon all such inventions; and upon the issue of letters patent, to assign and deliver the same to the Trustees to be by them held as aforesaid; and further agrees to execute and deliver all such other writings, whether powers of attorney, original conveyances or writings of further assurance as may be requisite to vest a complete title to each and every such invention in the Trustees as the same becomes capable of legal transfer; and further agrees to give concurrently herewith sole and irrevocable power of[a] attorney with power of substitution authorizing and requiring the Trustees in the name of said Edison to grant licenses under and make any absolute or limited conveyance of any such invention made or completed by him prior to January first, one thousand eight hundred and eighty four, and not specifically assigned to them for any cause, to persons appointed by Drexel, Morgan and Company who shall have become purchasers of any of the inventions hereby contemplated; granting to such purchasers in respect to such new inventions the same or no greater estate, interest or right of use than that owned by them in the inventions originally purchased.[d]

Fourth: The Trustees hereby accept the trust imposed by this agreement and the instruments herein provided for; and agree to hold and convey the title of all said inventions subject and according thereto.[d]

Fifth: Inasmuch as the sums of money which may be requisite under the stipulations of the first clause hereof cannot be presently ascertained, and Drexel, Morgan and Company are unwilling to bind themselves, without reserve, for the payment of indefinite sums, the utility of which cannot be foreseen, and Edison is unwilling to part absolutely with all power over his inventions and at the same time subject himself to the possibility of great loss and injury through misapprehension by Drexel, Morgan and Company of the true value and importance of some particular inventions or of the whole of his system as it may be completed; it is agreed, in respect to all the advances or disbursements herein provided for.[d]

(First:) That the same are to be made at the risk of the business and be repayable, with seven per cent, interest,[h] out of the net proceeds of the sale or disposition of said patents and are not to constitute in any other manner a debt or obligation of Edison.[d]

(Second:)—That Drexel, Morgan and Company shall be the sole judges of the time, manner and degree of expense of such exhibition as shall be made in London or elsewhere in Great Britain.[d] ⟨& Ireland⟩[3i]

(Third:)— That whenever Drexel, Morgan and Company shall fail or refuse to advance the sums requisite to obtain or defend letters patent for any invention, it shall be at the option of Edison, within a time specified in a notice in writing to be served by him upon Drexel, Morgan and Company and each of the Trustees—(and which shall not be less than two nor more than three months—) to require a reconveyance by the Trustees to him of all right, title and interest remaining in them in said invention, or, if in his opinion such invention is a necessary part of his general system, then to require in like manner a reconveyance of all his inventions then remaining in the Trustees, and not sold or disposed of or agreed to be, in good faith, by Drexel, Morgan and Company; and after the giving of any such notice the interest of Drexel, Morgan and Company in such invention or the proceeds thereof shall cease, But since the stipulation last foregoing is made only to secure Edison against loss and injury arising from the causes above mentioned, and not to give him that power in cases of honest and intelligent difference as to what is a useful or necessary expenditure in any particular case, it is further provided that upon the receipt of any such notice, Drexel, Morgan and Company may, by notice to the Trustees and Edison, require an arbitration of three disinterested and qualified persons upon the question whether their refusal to make such advances was justified, having in view the interest of both parties as joint participants in the profits of sale as above provided; and upon the decision of such arbitrators in favor of Drexel, Morgan and Company, the notice by Edison shall be held void and of no effect.[d]

(Fourth:)— No cancellation of the interest of Drexel, Morgan and Company or termination of their control hereunder shall impair the obligation of any contract which they may, under the Seventh article hereof, have entered into with the purchaser or intending purchaser of any existing invention in respect to the future inventions of Edison.[d]

Sixth: The expenses chargeable to and payable out of the joint account, shall be held to include whatever sums may be expended in applying for, obtaining and defending at law letters patent for the said inventions; the cost of exhibitions in England; the reasonable expenses of said Edison and a suitable allowance for his time should he be required by Drexel, Morgan and Company to visit England, together with the commissions and all other charges customarily incident to the promotion of companies or negotiation of loans in London, but shall not be held to include any share or participation in this contract which Drexel Morgan and Company may deem it necessary or expedient to grant to other bankers, financial agents or associates; and all such share or participation will be deducted exclusively from the moiety of Drexel, Morgan and Company.[d]

Seventh:[g] Edison agrees concurrently herewith to constitute Drexel, Morgan and Company his attorneys in fact with power of substitution, in his name to sell and convey, and agree to sell and convey, to such persons as may be purchasers of any of his said inventions, a like interest in all future inventions which may be made by or for which letters patent may be granted to him subsequent to the termination of the period of five years above mentioned; the consideration therefor to be ascertained in case of failure by the purchasers to agree with Edison, by arbitrators to be appointed by Edison and the purchasers in a manner similar to that hereinafter provided, it being the purpose of this clause to give Drexel, Morgan and Company a means of assuring to the purchaser of any invention, the title to which is invested or intended to become vested in the Trustees hereunder, the option to acquire a like title or interest in and to all other inventions or letters patent made or issued after the five years above mentioned; and to assure to the said Edison a fair means of determining the price to be paid therefor; and the price, when so ascertained, shall be payable to Drexel, Morgan and Company and be divided equally between them and the said Edison, in the case of all inventions for which they have advanced or paid the expenses described in the First article hereof.[d]

Eighth: The term "purchaser" as used herein shall be deemed to include all persons who by assignment, license, or otherwise may acquire any interest in or right to use any of said inventions. The term "invention" shall be construed to include all discoveries, improvements and letters patent, issued therefor.[d]

In all cases of difference, arising between the parties under this agreement, the same shall be determined by the Trustees, provided however, that either party may elect, in any particular case, either before or within a reasonable period, after the decision of the Trustees, to call for an arbitration by three disinterested persons, and in that case each party shall have the right to choose one, which two shall choose a third, and the decision of such arbitrators upon any question submitted to them shall be final.[d]

Ninth: The said Edison agrees, when requested by Drexel, Morgan and Company or the Trustees, to execute separate instruments repeating the different covenants and stipulations and powers of this agreement separately for more convenient use for filing or public records, or for production in any legal proceeding where it is not desirable or necessary that the interests of the parties hereunder shall be shown. This agreement shall bind the parties of the first and second part, their respective assigns and personal representatives.[d]

In Witness whereof the parties hereto have hereunto set their hands and seals the day and year first above written.[d]

Thomas A Edison[j] Drexel Morgan & Co[j]
Egisto P. Fabbri[j] Grosvenor P. Lowrey[j]
Sealed and delivered in the presence[k] of Geo. W. Soren.

(See memorandum annexed)[l]

ADDENDUM[m]

The foregoing agreement contemplates the concurrent execution and delivery of.[4][d]

1. A special power by Edison to Drexel, Morgan and Company authorizing them to sell all his interests (equitable or beneficial) in existing and future inventions of the five year period, and letters patent to be granted thereon, and to agree with the purchasers of any invention that they are to have the

title to all the like inventions made within seventeen years from date of foregoing agreement; subject however as to inventions subsequent to July 1884, to a compensation to be fixed by arbitrators.[d]

2. Power by Trustees to Drexel, Morgan and Company, authorizing them to dispose of Trustees' interest (legal title), and engaging to make over such title as is in them from time to time to Drexel, Morgan and Company's appointees; and agreeing to exercise the power of attorney given by Edison to them under the last part of the Third Article.[d]

3. Special assignment described in the Second Article.[d]

4. Power of Attorney contemplated by the last clause of the Third Article with power of substitution.[d]

Thomas A Edison   Drexel Morgan & Co
E. P. Fabbri Trustee

DS (photographic transcript), NjWOE, DF, Supp. IV. Notarization omitted. [a]Date taken from text, form altered. [b]"thirty first" written in another hand. [c]"December" written in another hand. [d]Followed by line to right margin. [e]"fill in due sum" written in margin in unknown hand. [f]"One thousand—(1000)—" written in another hand. [g]"X" written in margin. [h]"7% on charges" written in margin in unknown hand. [i]In an unknown hand. [j]Seal affixed next to signature. [k]"Sealed and delivered in the presence" spanned by brace. [l]Paragraph written in margin. [m]Addendum is a DS.

1. The agreement may not have been signed on 31 December 1878. It was not notarized until 22 July 1879, at which time Fabbri and Lowrey swore before Daniel Seymour, a New York notary, that they had indeed signed the agreement as trustees and Fabbri indicated that he had also signed as copartner of Drexel, Morgan & Co. A 6 December draft of this document is in DF (*TAEM* 18:238).

2. Edison's first British electric light patent (No. 4,226 [1878]) had been filed on 23 October.

3. Although this marginal addition was not initialed, it was included in later documents such as the power of attorney mentioned in note 4.

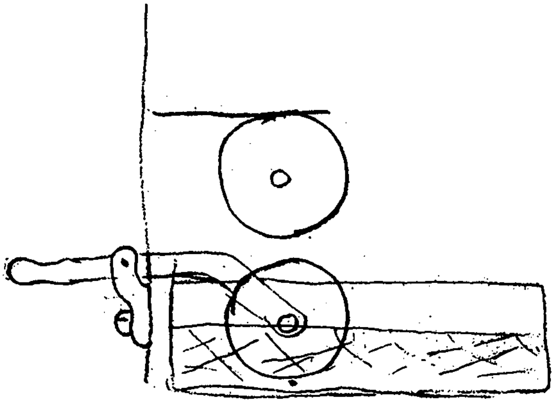
4. Photocopies of the following legal documents, all dated 1 March 1881, are in DF, Supp. IV; a typed copy of Edison's power of attorney to Drexel, Morgan & Co. is in Miller (*TAEM* 86:373).

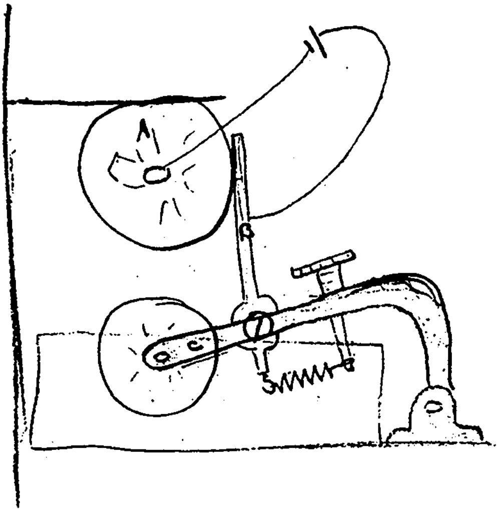
-1650-

[Menlo Park,] Dec 31st 1878

Notebook Entry: Telephony

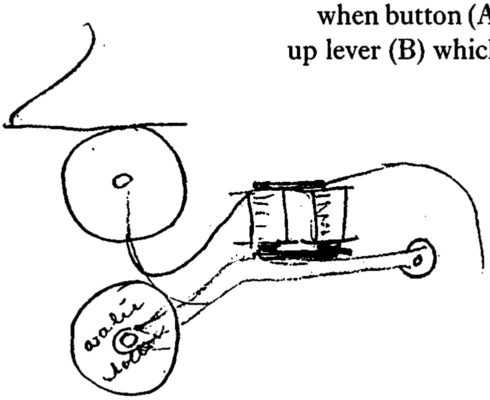
New Receiver

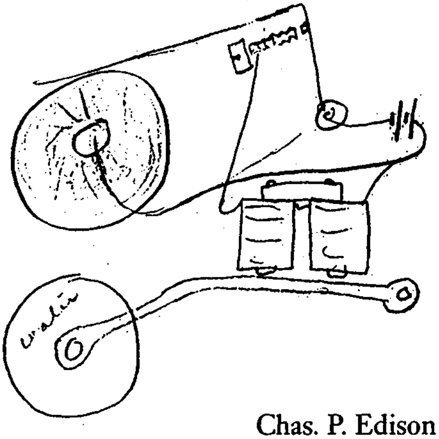




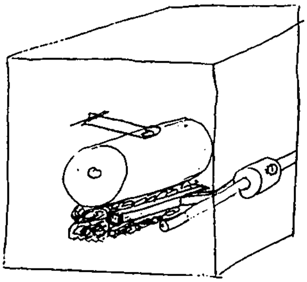
friction feed—[a]

when button (A) is dry there is greater friction which draws up lever (B) which elevates lever (C) with moist roller[1]





Chas. P. Edison



Charles Edison's 26 December sketch.

X, NjWOE, Lab., N-78-12-31:7 (*TAEM* 30:380). Written by Charles Edison. Document multiply signed and dated. [a]Paragraph preceded and followed by centered horizontal lines.

1. Text is "water roller" in the first drawing below and "water" in the second drawing. On 26 December, Charles Edison had sketched a means of supplying moisture to the electromotograph cylinder using what appears to be absorbent batting and an adjustable trough (N-78-12-02:229, Lab. [*TAEM* 29:548]). Similar drawings from around this time are in N-79-03-20:135–37, Lab. (*TAEM* 33:62–63).

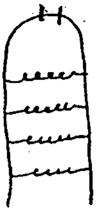
-1651-

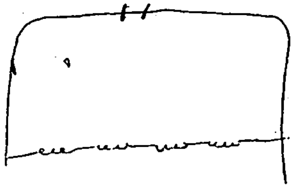
Notebook Entry: Electric Lighting

[Menlo Park, December 1878][1]

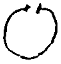
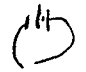
Dec. 15 These problems given to me when I first came into the ~~shop~~ laboratory.

Example No 1[2]





100 Lamps 10 000 ohms. 100 Lamps 1 ohm. How much heat in each lamp. Heat = C^2R
Ans the same

No. 2[3] If  battery short circuited consumed one oz Zn. in given time how much Zn. will  two cells short circuited consume Zn = C^2R ~~4 oz~~ 2 oz

Ex. 3 Through 1 ~~o~~Ohm outside[a]

Ex. 4[4] If a two horse power engine will heat to incandescence[b] a Cu. rod ¼ inch in diameter of a ~~le~~ having a length of 30 inches how many lamps per horse power.

~~We took the resistance of the Cu and of Pt and surface of Pt as compared to Cu &c and found an estimate of five or six as Ans.~~[c]

Ex. 5[5] In using[d] one ton of coal[d] the same as 1300 pounds distroyed to make 10 000 Cu. ft. of gas 10.000÷5 = 2000[e]

~~Tw~~ 2000 gas burners for one hour at 5 cu. ft. per burner = 30.000 candles

1300 lbs of coal will run a[d] 650 Horse ~~p~~Power engine one hour

Jablochkoff claims 600 candles per horse power

650
600
390.000 candles for 1300 lbs[d] of coal[f]

650
90
58.400[a]

6 lamps of 15 ~~burners~~ candles[g] per horse power = 90 candles

30.000 ~~f~~candles for gas 58.400 for pt. lamps 390.000 Jablochkoff[f]

Ex. 6 How many pounds of Pt. will one Horse power heat one degree Fahr[h] in one minute.[6] 33.~~0~~000÷772 = 42[e]

One Horse power will heat 42 lbs. of H_2O in in one minute

Sp[ecific] heat of Pt 33 to H_2O = 1

42
33
1386[e] lbs. of Pt. heated one degree Fahr. in one minute[f]

Ex. 7.[7] Battery 2 ohms Lamp 3 ohms Electromotive force 8 ¼ inch radiating How much heat Ans 7.7[a]

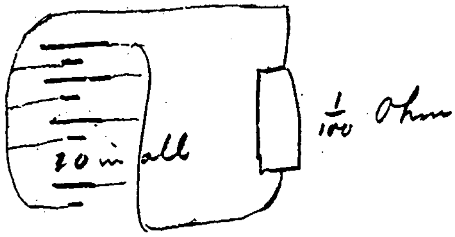
Ex. 8 The same as No 7 except lamp 6 ohms Ans. 6.6[f]

Gravitation is not really a force it is only a condition of matter.[8] E.[9] The same with magnetism.[f]

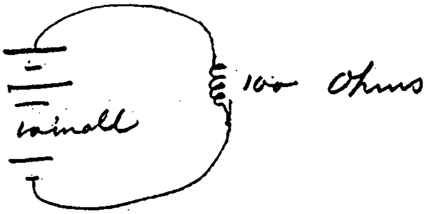
An induction coil may be short circuited by bringing a ring of metal round the field. The first small Wallace had this defect as on the ends of the magnets there was placed a ring of metal. Edison

Ex. 9 The gearing of wheels and the weight to be applied to revolve magneto machines.[10]

Ex. 10[11] Heat on wire in this circuit



as compared to this



various resistances in battery

Etheric Force[12]

If it were electricity of high tension there would be very small heating effects for even large sparks.

When the wires are brought to an iron surface for contact, bright scintillations can be seen showing strong dynamic force.[a]

When a magnet is made and remade the whole air and region about it are thrown in a strong diamagnetic stress.

If this stress is removed and wires are left in the field[13] the force will show itself in a spark. If the connection is broken of the wire where does the stress go to? Heat was my first answer, but the following experiment[14] seems to show that there may be a new form of ~~energy~~ energy.[a]

Relays made short to prevent induction. Long magnets give the greatest spark. A short magnet answers almost instantly while on a long magnet the time can readily be heard.[15a]

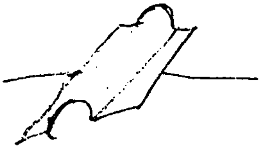
Useless friction or resistance[i]—in the commutator much worse in a machine for intensity than in one for quantity owing to % of loss.[16]

Machine 100 ohms
Commutator 1 "
1%[a]
Machine 1
Commutator 1 100%

Ex. 10 ~~Hor~~ If horse power costs 8/10 of a ct per hour. How much can be expended on a machine to save one horse power the machine to run 10 hours each day.

365
.008
2.920
10 hours in day
$29.20
10 interest 10%
$292.00 the interest of[17j]

Ex. 11 Why should not a one turn of a coil have as much effect as many if it offers equal~~s~~ resistance, for example the whole magnet could be encased in carbon[18]



Wire used to prevent vibrations This could be effected with a rod dampened with rubber. The finger is the best known substance for dampening vibrations and rubber comes next T.A.E.[19a]

Carbon lamps polarizing[20] the machine must be driven at a higher velocity to overcome this which increases the resistance.[a]

When the holds of coal ships were ventilated a large no. were burned, since the custom has ceased very few burn. This shows that there can be a slow combustion[d] of coal, a slow oxydation at low temperatures. A battery is an appliance by which the slow combustion of Zn. is taken advantage[21] to produce electricity.[d] Zn. and acids cost very much, coal and air are very cheap, if a battery could be made using coal it would be extremely economical. There might be, for example, large pits in which coal could be dumped, and wires then carried away. Carbon and Oxygen have the most powerful affinity for each other of any known substance at high temperatures.[a]

Large thermo piles might be made to utilize the heat as it came from the combustion of coal.

If the world wags on for many thousand years more, there would seem to be no reason why men should not go on discovering and inventing. No reason to doubt that new tricks and arrangements will be made so that Nature may work to man's advantage. The scientific journals will go on publishing, Poggendorrff[22] the Philosophical ~~m~~Mag. will be full then as now. It is the unreasonable for men today to be afraid that they cannot find out any more that all has been found.

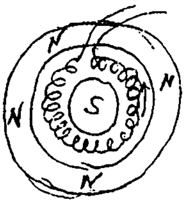
Men are just beginning to propose questions and find answers, and we may be sure that no matter what question we ask, so long as it is not against the laws of nature a solution can be found.[a]

What is now to be solved is this question. To take the heat from a large coal fire under a boiler and carry to various points raise its intensity and utilize it for lighting[a]

If it were not for the eye light could not be detected by any known reaction, except the decomposition of a few salts and the indication of the thermo-pile If the race were blind to the light rays as they are to the chemical rays and[k] had eyes which could measure heat rays.[d] It would have been many years before the existance of light would have been suspected as it was many years before the chemical rays were suspected.[23]

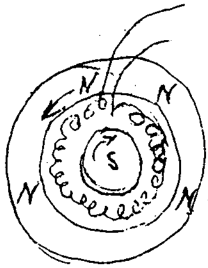
On the doctrine of conservation of energy only a small fraction of the total energy is light. For example, according to Thompson only 1/1000 of the enery of a gas flame is light,[24] and most experiments have a larger probable error[d] than this.

Ex. 13 Why[d] should not this machine give a constant current?



Wire revolve

Ex. 14.

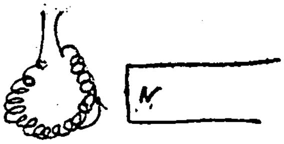


wire still[a]

To be tried. A ring of steel and a current passed round in a coil wound completely round to break the ring and find whether it is magnetic.[25] A Bell telephone will answer back on the return beat of the diaphragm thus giving an echo or what corresponds to an echo. Thus a simple tap on one diaphragm will be by this echo made into[26a]

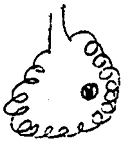
Clocks may change their rates ~~be~~ as their position[d] is varied, as the pendulum may pick up earth currents and thus retard it.[27a]

Ex. 15

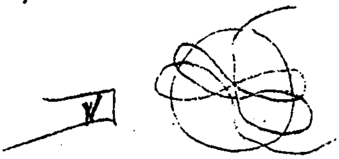


Would this give constant current

Ex. 16



Ex. 17



Wire wound in the form of a fig. 8 and revolved No current[28]

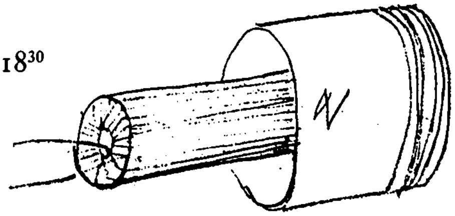
Mr. E. says that he always considers in working for the quadruplex that he was only working from one room to another and thus he was not confused by the amt. of wire and the thought of the distance[a]

Phosphorescence may be called the induction of light. The induction of Elec. means that matter is put under a strain which when removed gives a current. Thus a substance exposed to light is put under a strain wh. when removed shows itself in the form of light

In looking through the spectroscope Mr. E. noticed that the light the sky being perfectly clear would vary greatly in brightness There would suddenly be a lighting up of parts of spectrum running lengthwise He watched some hours and at one time noticed the phenomena ~~of re~~ with great clearness, and saw that a very small clou~~l~~d could be seen.[a]

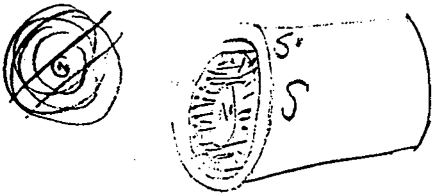
Why could not a diffraction grating be~~ing~~ made by rotation[29a]

Ex. 18[30]



Wire wound on wooden core and revolved. Would their be any current?

Ex. 19

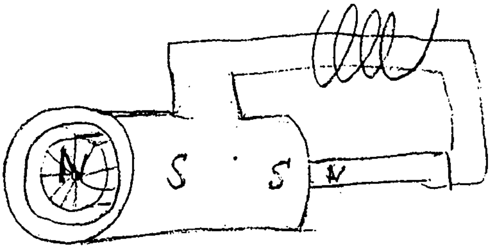


Wire wound on inside coil between[d] the two poles.

An electrometer may be considered as a galvanometer of great resistance. For example a 20,000 Ohm galvanometer will give indications exactly corresponding to the electromotive force of a battery. If we could have a galvanometer with a resistance equal to that of an inch of air it would give almost perfect indications of electromotive force E[31a]

The electromotive force of an element[l] is dependent on the chemical force existing between the substance and the exciting The amount of electricity depends on the number of molecules[32]

Ex. 20



Core wound in fig 8 and revolved would it give a constant current? no

The question as to the winding

If the current from a Bell telephone is ~~put~~ received round a soft iron core very little effect is produced. The current is lost in twisting the molecules

Vol II Phil. Mag. P. 135[m] mention of Aetheric force.[33n]

X, NjWOE, Lab., N-78-12-20.3:2 (*TAEM* 30:519). Written by Francis Upton. [a]Followed by horizontal line at left margin. [b]"to incandescence" interlined above. [c]Followed by two horizontal lines at left margin. [d]Obscured overwritten letters. [e]Form of equation altered. [f]Followed by centered horizontal line. [g]Interlined above. [h]"one . . . Fahr" interlined above. [i]"or resistance" interlined above. [j]Followed by three horizontal lines. [k]Repeated at bottom of one page and top of next. [l]"of an element" interlined above. [m]Underlined three times. [n]Paragraph enclosed by lines drawn across page.

1. Upton signed and dated the first page of this notebook on 20 December. He compiled much of the material from notes he made in another notebook from the time he arrived at the laboratory (around 15 December) through the end of December. Edison signed and dated Upton's original notes. The problems recorded here indicate something of the direction of research at the laboratory during the last half of the month. Several entries also record Edison's comments regarding a variety of scientific and technological questions. N-78-12-16:1–229, Lab. (*TAEM* 29:1076–1178).

2. The drawing on the left represents one hundred lamps and one

ohm resistance and the drawing on the right represents the other case. In this and examples 2, 7, and 8 Upton is using Joule's law. Upton's undated notes and calculations for this problem are in N-78-12-16:3–9, Lab. (*TAEM* 29:1078–81).

3. Upton made undated calculations in N-78-12-16:10–15, Lab. (*TAEM* 29:1082–84).

4. Upton's undated calculations are in N-78-12-16:27–34, Lab. (*TAEM* 29:1090–94).

5. This example is substantially the same as a 17 December notebook entry in which Batchelor stated that 1,300 pounds of coal would yield enough gas to produce the equivalent of 30,000 candles of light. He then calculated that Jablochkoff lamps would produce "13 times more than gas" for the same amount of coal. Including the cost of carbon, this light "would be 4⅓ cheaper than gas." Batchelor stated that "We get 6 lights per HP if 90 can. per HP we should have 58,500 candles" from 650 horsepower. Upton worked through this example on 18 December, using the same figures as Batchelor. N-78-12-11:17–21, N-78-12-16:65–66, both Lab. (*TAEM* 29:687–89, 1109–10); cf. Doc. 1577 n. 2 and Bowers 1982, 105–7.

6. One horsepower equals 33,000 foot-pounds per minute, and 772 foot-pounds will heat one pound of water 1°F.

7. Upton's notes for this problem from 18 December are in N-78-12-16:71–75, Lab. (*TAEM* 29:1112–14).

8. The meaning of "force" in the physical sciences and philosophy was a matter of some controversy during this period; that magnetism and gravitation were both significantly different from other commonly discussed physical forces had been suggested several times by Michael Faraday. Spencer 1966, 265–69; Spencer 1898; Tait 1876, 338–63; Faraday 1859, 443–63; Faraday 1965, 3:566–74.

9. This is the first of Edison's comments, as opposed to specific problems, that Upton recorded in this summary and in his other notebooks. Many of these ideas were entered by Upton on the left hand page of the notebook containing the summary, while he recorded the problems on the right. The original, dated 18 December, is in N-78-12-16:95, Lab. (*TAEM* 29:1123).

10. See Doc. 1636 n. 1.

11. Text is "10 in all" and "1/100 ohm" in first drawing below and "10 in all" and "100 ohms" in second drawing. Related calculations, dated 20 December, are in N-78-12-16:109–11, Lab. (*TAEM* 29:1130–31).

12. The following discussion of etheric force is apparently Upton's record of Edison's thoughts on the matter and is substantially the same as notes Upton made on 20 December. They are not the only instance of Edison's concern with etheric force at this time. The 28 December *New York Daily Graphic* included an interview with Edison in which he stated that "while we were experimenting last night with the electric light I got some more indications of the presence of some subtle, evasive force that I could not call electricity or anything else with which we are acquainted." Asked if it resembled the etheric force Edison claimed to have discovered several years before, he replied "Yes, it is the same—if that was anything, and I rather think it is something—a new radiant force, lying somewhere between light and heat on one hand and magnetism and electricity on the other." He remarked that it did "not respond

to any of the physical tests of electricity, except the spark." N-78-12-16:113–16, Lab. (*TAEM* 29:1132–34); "Two Hours at Menlo Park," Cat. 1241, item 1091, Batchelor (*TAEM* 94:444).

13. This point roughly follows Michael Faraday's general conceptual approach, which regards the space and air around magnets as being in an altered physical condition, one that contains energy and force. Faraday, however, reported that the atmosphere is paramagnetic, not diamagnetic, and that this is primarily due to oxygen. Faraday 1965, 3:sections 3464–81, 2770–96, 2853–63.

14. No experiment was recorded here or in Upton's other notebook (see note 1).

15. Edison had experimented extensively with short- and long-core electromagnets for telegraphy. See, for example, Docs. 363, 375, 386, 392, 477, and 878; *TAEB* 2:139 n. 16, 245 n. 8, 353 n. 3.

16. In another notebook entry, dated 20 December, Upton had written, "Useless friction, as in the commutators, is much worse in a ~~tension machine~~ quantity machine than in a tension machine Owing to diff % of loss." He also noted that if a dynamo's field magnets vary in strength "the friction will be increased to run the machine at a higher rate." N-78-12-16:121–22, Lab. (*TAEM* 29:1136–37).

17. That is, if money can be invested at ten percent interest, spending more than $292 to save one horsepower is wasteful. See similar calculations dated 20 December in N-78-12-16:116, Lab. (*TAEM* 29:1134).

18. Similar sketches that may be related to this one were dated 27 December. N-78-12-16:133, Lab. (*TAEM* 29:1142).

19. On 20 December, Upton noted: "Wire brush commutators used to prevent largely vibrations. This could be effected with rod combined with rubber." N-78-12-16:122, Lab. (*TAEM* 29:1137).

20. Here and in the preceding and following paragraphs Upton appears to be recording Edison's thoughts. It is not certain what "carbon" means here, but it may refer to lamps such as are the subject of Docs. 1565 or 1568. In that case, "polarizing" could indicate a surface reaction at the point of contact between the different incandescing substances in the lamp. A "polarizing" phenomenon in arc lights was described in a November article by the English electrician John Sprague (Sprague 1878b).

21. Upton had written "Ex. 13   1000 cells   1000 local action" at the top of the next page. He crossed out the phrase in order to use the page for this paragraph and the one following.

22. Use of the last name of Johann Poggendorff (1796–1877) to indicate a publication in the nineteenth century generally referred, even after his death, to the *Annalen der Physik und Chemie,* (also known as "Poggendorff's *Annalen*") which he had edited since 1824, while in the twentieth century this generally refers to the *Biographisch-Literarische Handwörterbuch zür Geschichte der exakten Wissenschaften,* which he began in 1863. Poggendorff's *Annalen* was one of the most respected journals in the physical sciences. *DSB,* s.v. "Poggendorff, Johann Christian."

23. Chemical effects of light were not identified until the later eighteenth century. The existence of distinguishable heat and chemical rays (i.e. infrared and ultraviolet radiation) beyond the ends of the spectrum of visible light was demonstrated by William Herschel in 1800 and by

Johann Ritter in 1801, respectively. *DSB*, s.vv. "Herschel, William" and "Ritter, Johann Wilhelm."

This paragraph and the next one are substantially the same as Upton's notebook entry dated 28 December. N-78-12-16:162–63, Lab. (*TAEM* 29:1146).

24. In one of his literature search notebooks Upton noted that Danish chemist and physicist H. P. J. Julius Thomsen had estimated in his 1865 paper "On the Mechanical Equivalent of Light" (*Phil. Mag.* 4th ser. V. 30: 246–49) "that the heat given out . . . in gas flame [is] 1000 times more than the light" (Literature Search Notebook #2:11, Upton [*TAEM* 95:403]). Later measurements are in line with the estimate (see e.g. Thompson 1910, 313, 364–65).

25. A related experiment using a soft iron ring is in N-78-12-04.1:36, Lab. (*TAEM* 29:581).

26. Upton more fully described this phenomenon on 29 December: "When on Bell telephone a motion is given to one diaphragm the other in answering will give a return current when it returns and so an echo as it were, will be made and a humming sound will result." N-78-12-16:181, Lab. (*TAEM* 29:1155).

27. Upton noted on 29 December: "In clocks the pendulum will pick up earth currents and thus they will change their rates of movement if their direction is changed." Earth currents are caused by differences in the electrical potential of the earth. N-78-12-16:181, Lab. (*TAEM* 29:1155).

28. See Doc. 1641 n. 2.

29. Upton made similar notes of Edison's remarks about spectroscopy on 29 December. N-78-12-16:184–86, Lab. (*TAEM* 29:1157–58).

30. On 30 December, Upton again sketched this arrangement and noted "Coil revolved and no current as it ought to be." N-78-12-16:194, Lab. (*TAEM* 29:1162).

31. Upton made substantially the same notes in N-78-12-16:196–97, Lab. (*TAEM* 29:1163).

32. In another, undated entry probably made on 30 December, Upton wrote that "The electromotive force is dependent on the chemical force existing between the substance and its exciting liquid or solid. The current depends on the number of molecules changing condition." N-78-12-16:197, Lab. (*TAEM* 29:1163).

33. This refers to a paper by Oliver Heaviside, "On the Extra Current," concerning electrical oscillations in a wire caused by induction, to which Heaviside attributed the effects observed in "Mr. Edison's 'aetheric-force' experiments." Heaviside 1876.

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Appendix 1

Edison's Autobiographical Notes

In 1908 and 1909 Edison wrote a series of autobiographical notes whose origin and nature are described in the first appendices of Volumes One and Two.[1] Six of the documents contain sections related to events of the period of Volume Four; those sections are published here.[2] Edison sometimes referred in the same paragraph to the periods covered by more than a single volume; such notes will be reprinted as appropriate. Each document has been designated by a letter and each paragraph sequentially numbered.

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[1] General considerations are presented in *TAEB* 1:627–28 and specific information on six of the autobiographical documents, designated A–F, follows there. A seventh autobiographical document, G, is described in *TAEB* 2:777, 781.

[2] The autobiographical document designated F does not refer to the period of this volume.

A. BOOK NO. 1

The following is from a typescript prepared by William Meadowcroft from an 11 September 1908 notebook written by Edison; see Volume One, p. 628. Five of the thirty-five paragraphs in the notebook pertain to the period of Volume Four.

NOTES OF T. A. EDISON

[1] In 1878 I went with a number of astronomers to Rawlings, Wyoming Territory, to observe the eclipse of the sun and incidently test an instrument which I had devised called a

"Tasimeter." There were astronomers from nearly every nation; we had a special car. The country at that time was rather new, game was in great abundance and could be seen all day long from the car window, especially antelope. We arrived at Rawlings about 4 P.M.— Rawlings had a small machine shop and round house and it was at this point where Locomotives were changed for the next section. The hotel was a very small one and by doubling up we were barely accommodated. My room mate was E. M.[a] Fox, correspondent of the N.Y. Herald. After we retired and were asleep a thundering knock on the door awakened us; upon opening the door a tall handsome man with flowing hair dressed in western style entered the room; his eyes were bloodshot and he was somewhat inebriated. He introduced himself as "Texas Jack" (Joe Chromondo) and said he wanted to see Edison as he had read about me in the newspapers. Both Fox and myself were rather scared and didn't know what was to be the result of this interview. The landlord requested him not to make so much noise and was thrown into the hall; Jack explained that he had just come in with a party who had been hunting and that he felt fine; he explained that he was the boss pistol shot of the West, that it was he that taught the celebrated Dr. Carver how to shoot and then suddenly pointing to a weather vane on the freight depot, pulled out a Colt, revolved and fired through the window hitting the vane. The shot awakened all the people and they rushed in to see who was killed, it was only after I told him I was tired and would see him in the morning,that he left; both Fox and myself were so nervous that we did not sleep any that night. We were told in the morning that Jack was a pretty good fellow and was not one of the "badmen" of which they had a good supply. They had one in the jail, and Fox and I went over to see him. A few days before he had held up a Union Pacific train and robbed all the passengers. In the jail was a half-bred horse-thief. We interviewed the bad man through bars as big as railroad rails. He looked like a bad man, the edge of his ears all around came to an edge and was serrated. His eyes were nearly white and appeared as if made of glass and set in wrong like the life size figures of indians in the Smithsonian Institute. His face was also extremely irregular, he wouldn't answer a single question. I learned afterwards that he got seven years in prison while the horse-thief was hanged. As horses ran wild and there was no protection, it meant death to steal one.

[2] The first thing the astronomers did was to determine with precision their exact locality upon the earth; a number of observations were made and Watson of Ann Arbor with two

others worked all night computing until they agreed; they said they were not in error more than 100 feet and that the station was 12 miles out of the position given on the maps. It seemed to take an immense amount of mathematics. I preserved one of the sheets which looked like the time table of a Chinese Railroad. The instruments of the various parties were then set up in various parts of the little town and got ready for the eclipse which was to occur in 3 or 4 days. Two days before the event we all got together and obtaining an engine and car went 12 miles further west to visit the U.S. Government astronomers at a place called "Separation," the apex of the Great Divide, where the waters run east to the Atlantic and west to the Pacific. Fox and I took our Winchester rifles with an idea of doing a little shooting. After calling on the Government people we started to interview the Telegraph Operators at this most desolate and lonely spot. After talking over old acquaintances I asked him if there was any game around; he said plenty of jack rabbits. These jack rabbits are a very peculiar species; they have ears about 6 inches long and very slender legs, about three times as long as an ordinary rabbit, and travel at a great speed by a series of jumps, each about 30 feet long, as near as I could judge. The local people call them narrow gauge mules. Asking the operator the best direction he pointed west and noticing a rabbit in a clear space in the sage bushes, said there is one now— I advanced cautiously to within 150 feet and shot; the rabbit paid no attention, I then advanced to within 100 feet and shot again; the rabbit still immovable. On looking around the whole crowd at the station were looking and I then knew the rabbit was stuffed. However, we did shoot a number of live ones until Fox run short of cartridges; his rifle had a different bore than mine, and he could not use mine, of which I had plenty. On returning to the station, I passed away the time shooting at cans set on a pile of ties, finally the operator said to Fox, I have a fine Springfield musket, suppose you try it—so Fox took the musket and fired. It knocked him nearly over. It seems the musket had been run over by a hand car which slightly bent the long barrel, but not sufficiently for an amateur like Fox to notice. After Fox had his shoulder treated with arnica, etc. at the Government Hospital tent, we returned to Rawlings.

[3] I had my apparatus in a small yard enclosed by a board fence 6 feet high; at one end there was a house for hens I noticed that they all went to roost just before totality. At the same time a slight wind arose and at the moment of totality the atmosphere was filled with thistle down and other light

articles. I noticed one feather whose weight was at least 150 miligrams rise perpendicularly to the top of the fence where it floated away on the wind. My apparatus was entirely too sensitive and I got no results.

[4] The eclipse being over, Professor Barker, professor of physics of the University of Pennsylvania, Major Thornburg, several soldiers and a number of railroad officials and myself, went hunting about 100 miles south of the railroad in the Ute Indian country. A few months after this Major Thornburg and 30 soldiers were ambushed near our camp by the Utes and all were killed.

[5] Before coming out on this expedition, Mr. Gould who then controlled the Union Pacific and for whom I had done some work in connection with the Telegraph Companies in which he was interested, gave me a letter to the various superintendents requesting that I be permitted to ride on the cow catcher of the locomotive at my own risk— In those days the schedule time was very slow, being only 20 miles per hour. The different engineers gave me a small cushion and every day I rode in this manner from Omaha to the Sacramento Valley, except through the snow shed on the summit of the Sierra, without dust or anything to obstruct the view—only once was I in danger when the locomotive struck an animal about the size of a small cub bear, which I think was a badger. This animal struck the front of the locomotive just under the headlight with great violence and was then thrown off by the rebound. I was sitting to one side grasping the angle brace so no harm was done.

TD (transcript), NjWOE, Meadowcroft. Because this transcription of Edison's manuscript is presented only as a reference text, typographical errors have not been reproduced or noted. [a]Interlined above in unknown hand.

B. FIRST BATCH

The following is from a typescript that Edison revised ("Pencil indicates Mr. Edison's revision" is written on the front); see Volume One, p. 646. Three of its eighty-one paragraphs deal with the period covered by this volume.

NOISE ON THE NEW YORK ELEVATED.

[4] When the Elevated Railroad in New York, up Sixth Avenue, was opened about 1878, there was a great public clamor

about the noise, and injunctions were threatened. The management engaged me to make a report on the cause of the noises. I constructed an instrument that would record the sound and set out to make a preliminary report, but I found that they never intended to do anything, ~~but let the people complain.~~ I quit[a]

EXHIBITING THE PHONOGRAPH.

[23] When I got out the first tin foil phonograph I took it down to Washington at the instigation of Mr. ~~W.~~U[b] H. Painter. I was taken over to a relative of Mr. Blaine—Miss ~~Gail~~ Abigail[c] Dodge, a celebrated woman—in a private house. In those days there were two little things we used to recite to the phonograph. "Mary had a litle lamb;" and "There was a little girl who had a little curl." There was a crush of persons coming in and hearing it and going out, for 6 or 7 hours. Finally Rosco Conkling came in. It will be remembered that he was always caricatured with a little curl plastered down on his forehead. As I faced the phonograph against the wall, I could not see my visitors. When Conkling came in the first thing I did was to recite about the little girl with the curl. Everybody tittered. Rosco flushed up and became mad and walked out—for which I was not to blame.

[24] At 11 o'clock at night I and the phonograph with Mr. Painter were taken up to the White House and were ushered into a room. We found there President Hayes, Carl Schur~~t~~z, who was playing the piano, and several members of the cabinet. I set the apparatus going and kept on with it until 12:30. When I was going to take the phonograph away, President Hayes on the impulse said: "Wait a moment," and went upstairs. In 20 minutes he came down with Mrs. Hayes and three other ladies. They heard it and I did not get away until 3 o'clock in the morning.

TD (transcript), NjWOE, Meadowcroft. [a]"but . . . complain" canceled and "I quit" interlined above, both in pencil. [b]"W" canceled and "U" interlined above, both in pencil. [c]"Gail" canceled and "Abigail" interlined above, both in pencil.

C. SECOND BATCH

The following is from a typescript that Edison revised; see Volume One, p. 646. One of its twenty-four paragraphs deals with the period covered by this volume.

[16][a] It appeared that he [James Adams] had once been a slaver, and altogether he was a rather tough character. Having no other man I could spare at that time I sent him over with my carbon transmitter telephone to exhibit it in England. It was exhibited before the Post Office authorities. Professor Hughes spent an afternoon in examining the apparatus and in about a week came out with his microphone, which was absolutely nothing more or less than my exact invention. But no mention was made of the fact that just previously he had seen the whole of my apparatus. Adams stayed over in Europe connected with the telephone for several years and finally died of too much whiskey—but not of heart disease. This shows that whiskey is the more dangerous of the two.

TD (transcript), NjWOE, Meadowcroft. [a]This is the second paragraph following the heading "THE SAILOR IN SEARCH OF A JOB."

D. BOOK NO. 2

This undated notebook contains a mix of narratives, questions, and notes in Edison's hand; see Volume One, p. 648. Fourteen items pertain to the period covered by this volume; item 225 was previously published in Volume Three.

[38] Eclipse sun— Fox Herald Texas Jack— stuff rabbit— Bent gun armies govt hospital 400 bullets, antelope— fell off horse shot doe— Pass from Jay Gould— riding Cow catcher nearly knocked off by a badger[a]

[132] 100 000 telephone—6000 yrly— 100 000 for Chalk relay—6000 yrly Gould always sour.—

[225] When TCM 1st met u fall 1877 u wr rather deaf whats true story of beginning of this deafness its attributed to injury to ear drum by angry Conductor train official in 1877 it didnt interfere in any way with work on telephone or phonogh nor with tests for Elevated RR stoping noise.[b]

[230] Do u rember anythg abt the telephone line frm Cheevers ofs 203 Bdwy. & Hilbourne Roosevelts organ fac TCM remembers seeing you & E H Johnson trying it more than once in 1878 it must hav bn 1 of t 1st Lines on Manhattan

[231] Do u remembr anythg of phonogh Exhibit at Union Sq on Bdwy East side it was 1st in NY wasnt it E H Johnson organized it

[232] Did Bergman do any work in those early days outside

of phonogh Do u rember how they grew into biz You had Newark & Menlo Park going at same time The point is interesting as illustration of versatility & wide points of interest; even at age of 30[b]

[234] Any recollection of G P Lowrey & getting Capital—Did he come in before the days of Lighting. was he the channel to Villard—[b]

[256] ~~NY~~ J P Morgan came to lab—

[258] Elevated RR test of noise appease clamour saw didnt intend do anything quit—

[286] Mr Orton—test telephone young Phelps catch Brooklyn ferry Vanderbilt—[c]

[287] ~~Vanderbilt~~

[290] Frank Thompson visit Menlo—thought never be used on RR

[292] Exhibt phono. Blaines neice Mr Conklin—was little girl etc up to White House show presdt Shurz—& Hayes and others Mrs H got up 130 AM came down[c]

[396] WHV wouldnt go into Elec without he had control—[a]

AD, NjWOE, Lab., N-09-06-27. [a]Paragraph canceled with large "X". [b]Followed by centered horizontal lines. [c]Paragraph overwritten with checkmark.

E. NOTES

Taken from a notebook that has five pages in Edison's hand, these "Notes" are numbered consecutively from 1 to 33.

[3] 3= JPM came to Lab—[a]

[6] 6 Apparatus Record noise elevated RR popular clamour, made prelim[b] report & quit saw they never intended do anything[a]

[32] 32 Exhibited phono to Blains neice abigil gale Dodge, Conklin—White House 11:30 PM—12:30 Mrs Hayes Schurz played piano[c]

[33] 33 Mr Orton—test telephone, Young Phelps catch Brooklyn Ferry[a]

AD, NjWOE, Lab. N-09-06-27. [a]Paragraph overwritten with check mark. [b]Interlined above. [c]Paragraph overwritten with check mark; colons addded to time.

G. MR. EDISON'S NOTES

The following is a transcription of relevant portions of a typescript titled "Mr. Edison's notes in Book No. 2," probably prepared by William Meadowcroft in 1908 or 1909. See Volume Two, p. 781. Eight of its thirty-eight sections deal with the period of Volume Four; section 18 was previously published in Volume Three.

[18] Tests were made between N.Y. and Phila. Also between N.Y. and Washington, using regular W.U. wires. The noises were so great that not a word could be heard with the Bell receiver when used as a transmitter between N.Y. and Newark. Mr. Orton and W. H. Vanderbilt, and the Board of Directors witnessed and took part in the tests. The W.U. then started in to put them on private lines. Mr. Theodore Puskas of Budapest, Hungary was the first man to suggest a telephone exchange and soon after exchanges were established. The telephone department was put in the hands of Hamilton McKay Twombly, Vanderbilt's ablest son-in-law, who made a success of it. The Bell Company in Boston, also started an exchange, and the fight was on the W.U. pirating the Bell receiver and the Boston Co. pirating the W.U. transmitter. About this time, I wanted to be taken care of. I threw out hints of this desire. Then Mr. Orton sent for me. He had learned that inventors didn't do business by the regular process and concluded he would close it right up. He asked me how much I wanted. I had made up my mind that it certainly was worth $25,000, if it ever amounted to anything for central station work, so that was the sum I had made up my mind to stick to and get obstinate; still it had been an easy job and only required a few months and I felt a little shaky and uncertain. So I asked him to make me an offer. He promptly said he would give me $100,000. All right I said, it's yours on one condition and that is that you do not pay it all at once, but pay it to me at the rate of $6,000. per year for 17 years—the life of the patent. He seemed only too pleased to do this and it was closed. My ambition was about four sizes too large for my business capacity and I knew that I would soon spend this money experimenting if I got it all at once, so I fixed it so I couldn't. I saved 17 years of worry by this stroke.

[27] I immediately started making several large and better ones [phonographs], which I exhibited at Menlo Park to crowds. The P.R.R. ran special trains. Washington people

telegraphed me to come on. I took a phonograph to Washington and exhibited it in the rooms of Blaine's niece, members of Congress and the notable people of the city came all day long until late in the evening. I made one break. I recited Mary, etc. and another ditty. There was a little girl and she had a little curl right in the middle of her forehead, and when she was good she was very very good but when she was bad she was horrid. It will be remembered that Senator Roscoe Conklin, then very prominent, had a curl on his forehead and all the caricaturists developed it abnormally. He was very sensitive about the subject. When he came in he was introduced, but being rather deaf I didn't catch his name, but sat down and started the curl ditty. Everybody tittered and I was told Mr. Conklin was displeased. About 11 o'clock at night, word was received from President Hayes that he would be very much pleased if I would come up to the White House. I was taken there and found Mr. Hayes and several others waiting. Among them, I remember Carl Shurz, who was playing the piano when I entered the room. The exhibition continued till about 12.30 A.M., when Mrs. Hayes and several other ladies who had been made to get up and dress, appeared. I left at 2.30 A.M.

[28] For a long time some people thought there was trickery. One morning at Menlo Park a gentleman came to the Laboratory and asked to see the Phonograph. It was Bishop Vincent who with Lewis Miller, was the founders of Chatauqua. I exhibited it and then he asked if he could speak a few words. I put on a fresh foil and told him to go ahead. He commenced to recite biblical names with immense rapidity. On reproducing it, he said, I am satisfied now, there isn't a man in the U.S. who could recite those names with the same rapidity.

[29] After my return from the Eclipse of the sun (you have this I think) I went with Prof. Barker, Prof. of Physics in the University of Pa. and Chandler, Prof. of Chemistry in Columbia College, to see Mr. Wallace, a large manufacturer of brass at Ansonia, Conn. Wallace at this time was experimenting on series arc lighting. Just at that time I wanted to take up something new and Prof. Barker suggested that I go to work and see if I could sub-divide the electric light so it could be got in small units, like gas.

[30] On my return home, I started my usual course of collecting every kind of data about gas, bought all the transactions of the gas engineer societies, etc. All the back volumes of gas journals etc. Having gotten all the data and investigated

gas jet distribution in N.Y. by actual observations, I made up my mind that the solution of the problem of the sub-division of the electric light could be solved and made commercial.

[31] At Menlo Park while working on the phonograph, I made an arrangement with Col. Gouraud of London, to make a telephone to be used in starting the industry in England and the Continent. A large number were made and sent to Gouraud, who started to put up a telephone exchange. When he had proceeded a little way, he was threatened with a law suit by the owners of the Bell patent. The Bell Company were starting an exchange themselves. He cabled me that the law suit would prevent him from obtaining further money to carry out the enterprise. He would stop unless I could evade the patent on the Bell instrument. I cabled I thought I could do so and went right to work. I again had recourse to the phenomenon discovered by me years previous that the friction of a rubbing electrode passing over a moist chalk surface had its friction varied by electricity. I devised a telephone receiver which was afterwards known as the loud speaking telephone or chalk receiver. There was no magnet, simply a diaphragm and a small cylinder of compressed chalk, about the size of a thimble, an arm connected to the center of the diaphragm, extended outwardly and rested on the chalk cylinder and was pressed against it with a pressure equal to that which would be due to a weight of about 6 lbs. The chalk was rotated by hand. The volume of sound was very great, a person talking into a carbon transmitter in NY. had his voice so amplified that he could be heard 1500 feet away in an open field at Menlo Park. This great excess of power was due to the fact that the power came from the person turning the handle, the voice instead of furnishing all the power, as with the present receiver, merely controlled the power, just as an engineer working a valve could control a powerful engine. I made six of these receivers and sent them in charge of an expert on the first steamer. They were received and tested, and shortly afterwards shipped one hundred or more. At the same time I was ordered to send twenty young men after teaching them to become expert. I set up an exchange around the Laboratory of ten instruments. I would then go out and get each one out of order in every conceivable way. A man would be sent to each to find the trouble. When he could find the trouble ten consecutive times, using five minutes each, he was sent to London. About 60 men were used to get 20. Before all had arrived, the Bell Company seeing that we could not be stopped, entered

into negotiations for consolidation. One day I received a cable from Gouraud offering $30,000 for my interest. I cabled back that I would accept. When the draft came, I was astonished to find that it was for £30,000. when I thought it was dollars.

[34] In 1878, at Menlo Park I got up a device which I called a megaphone. It consisted of two large funnels of the best shape, determined experimentally. These were connected together and to a listening tube, the ends of which were inserted in the ear; with this instrument talking could be heard a distance of 3 miles.

[38] At Menlo Park one cold winter night there came into the Laboratory a strange man in a most pitiful condition. He was nearly frozen and he asked if he might sit by the stove; in a few moments he asked for the head man and I was brought forward. He had a head of abnormal size with highly intellectual features and a very small and emaciated body. He said he was suffering very much and asked if I had any morphine. As I had about everything in chemistry that could be bought I told him I had. He requested that I give him some so I got the morphine sulphate; he poured out enough to kill two men, when I told him that we didn't keep a hotel for suicides and he better cut the quantity down. He then bared his legs and arms and they were literally pitted with scars, due to the use of hyperdermic syringes. He said he had taken it for years and it required a big dose to have any effect. I let him go ahead in a short while he seemed like another man and commenced to tell stories, and there was about 50 of us sat around listening until morning. He was a man of great intelligence and education. He said he was a Jew, but there was no distinctive feature to verify this assertion. He continued to stay around until he finished every combination of morphine with an acid that I had, probably 10 oz. all told. Then he asked if he could have strychnine. I had an ounce of the sulphate. He took enough to kill a horse and asserted it had as good effect as morphine. When this was gone the only thing I had left was a chunk of crude opium, perhaps two or three pounds. He chewed this up and disappeared. I was greatly disappointed because I would have laid in another stock of morphine to keep him at the Laboratory. About a week afterwards he was found dead in a barn at Perth Amboy.

TD (transcript), NjWOE, Meadowcroft. Because this transcription of Edison's manuscript is presented only as a reference text, typographical errors have not been reproduced or noted.

Appendix 2

Charles Batchelor's Recollections of Edison

The following reminiscence about Edison's early electric light research was written by Charles Batchelor about the same time that he wrote five others concerning his work with Edison. Unlike those, which he entered in one of his daily journals (Cat. 1339) between October 1906 and February 1908, he recorded this on separate sheets of paper, and it was not published in Welch 1972 .

Eclips total of the Sun July 29 1878[a]

Mr Edison went with Prof Henry Draper— He went to Experiment with his Tasimeter an instrument he had invented to measure very small degrees of heat & if possible to discover & measure the heat spêctrum which observers then believed to exist in the extreme rays of the solar spectrum he believed at that time that he could measure to the 500 000 part of a deg. Faht. When he came back from this trip he told me of many projects to be worked up for future inventions amongst them one for transforming the power of the falls into[b] Electricity & utilizing it in the mines for drills etc He said he had talked a great deal with Prof Barker who was his companion in a journey to the Pacific Coast after they had observed the eclipse at Rawlings Prof B had told him of some experiments he had seen at William Wallace's place[b] at Ansonia Ct. & wanted him to go up there & see thèm— They arranged a visit & I accompanied them There we saw Mr Wallaces 'Telemachon' as he called it at work lighting up six arc lights in series the lights appearing between two plates of carbon one above the other lengthwise with their long edges almost touching ~~We talked long that night on the value this machine would be in transmitting~~ He also generated a current with one machine & drove another with a large coil of wire between them to represent distance We talked long that night on the value theis might be in transmitting power in the West & Edison arranged with Mr Wallace to send a machine to Menlo Park which he did about the middle of Sept of that year 1878

Some months previous to this & before Edison went west on the eclipse expedition I had assisted him in some experiments in which he was trying to raise to incandescence different substances[b] in order to make an Electric lamp We had no dynamo to produce current but we had a ~~large~~ lot of Bichromat of Potach battery of large capacity called Condit & Hanson Cells because we bought them from a firm of that name in Newark who ~~made installations~~ manufactured apparatus & chemicals[c] for[b] electroplating; with these we could make comparatively high or low volts with a correspondingly light or heavy currents— The result of these experiments was a very fine incandescence procured from very thin strips of carbonized paper about ¾″ long 1/16″ wide & the thickness of a visiting card before carbonizing say half a hundredth of an inch these were mounted in an instrumentes that we had in the laboratory called a Gassiots tube— It was a globe of glass that could be exhausted of air on the air pump & had a stopcock so that when the air was exhausted it[b] could be removed from the pump— In the inside there was a short brass rod which[d] rose from the centre about 1 inch with a small brass ball on the end & through the top there was another similar brass rod but longer ~~that~~ than[b] the first which[e] could be raised & lowered so that the balls could be made to touch or be set apart say ~~1~~2 inches— On these two rods I fixed[f] in place of the balls ~~I fixed~~ small clamps to hold the different materials that we experimented with We were very much astonished at the difference we noticed; when the pieces were illuminated[b] in the bulb, when we had exhausted the air both as to the ease with which we got the light & the length of time they would last

All these experiments were in his mind when he went west & I have no doubt he gathered from Proff Barker & the other scientific men on that trip all that ~~was being done In~~ had been done by other scientists in that line Indeed he came home full of projects for producing light in large quantities ~~like gas~~ & distributing it in small units as is done by gas— Early in September 1878 we were actively figuring out stations that could deliver current to houses which[b] could be used equally[b] for light, or for small powers such as pumps, sewing machines, printing presses & all sorts of manufacturing[b]— All these could be turned off and on at will without affecting any other— Mr Edison had had very little experience with dynamo machines but he knew what other scientists such as Joule & Siemens ~~Wilde and others~~[g] had said of them that in transforming energy they were more economical than steam engines— He knew that many installations were running in which 1 machine ran 3, 5 or possibly 10 lights but these were large candlepower & unweildly for domestic purposes & to replace gas— When he came back from the west we spent many nights talking over his ideas which were crudely about this: We can develop the electricity in large quantities & lead it wherever we want to use it by wires & then put in lamps or motors[b] which can be turned on or off without[b] affecting any other in the supply— He illustrated it to me by pipes carrying water, ~~and~~ a supply tank above fed a main & small pipes with stopcocks all along the main led to the return pipe which ran[h] to another tank below— A pump constantly lifting the water from below to the top tank— When you turned a stopcock[b] it let water through & represented a lamp or motor & the water found its way back to the top tank— When all were turned on it represented full current & pump working full capacity—

Before he went away he told me to make[i] all Faradays experiments on the single loop of wire cutting the field of force as he thought that that was the kind of machine he should use— After he came back he had me make a machine of this kind giving me the rough figures & all the data he had figured out on the armature

The machine Mr Wallace sent to the laboratory which [~~he~~?][j] Edison[d] had thought so much of whilst we saw it operat~~e~~ing at Ansonia he soon found was not at all adapted to his use, for, as he said, it chewed up all its power itself whereas he wanted a machine that give all its power to the outside c~~u~~ircuit & retained the least possible for its own use— We had by this time got a small Gramme machine but this would not suit his ideas— He used to say no machine will do for me unless it can give 90% of its power outside of itself

AD, NjWOE, Batchelor (*TAEM* 92:947). [a]Followed by centered horizontal line. [b]Obscured overwritten letters. [c]"manufactures . . . chemicals" interlined above. [d]Interlined above. [e]"than . . . which" interlined above. [f]"I fixed" interlined above. [g]"~~Wilde and others~~" interlined above. [h]"which ran" interlined above. [i]Sentence to this point written over erasure. [j]Canceled.

Appendix 3

"Thomas A. Edison" (Chicago Tribune), *by George Bliss*

George Bliss authored a biography of Edison that appeared in the 8 April issue of the *Chicago Tribune* and was reprinted in a revised version in the 15 May and 1 June issues of the *Operator.* The following year, Chicago publisher James Baird McClure edited *Edison and His Inventions,* which included a biographical sketch largely based on Bliss's account with additional material about the inventor and his inventions. These accounts of Edison's early life and career were extensively relied upon by subsequent biographers and are the source of many errors and misconceptions.

Chicago, April 8, 1878

THOMAS A. EDISON.[a]

Hitherto Unpublished Reminiscences of a Wonderful Genius.[a]

The Busy Life of One of the Greatest of American Inventors.[a]

His Career as a Newsboy, Amateur Chemist, Newspaper-Publisher, and Operator.[a]

Early Telegraphic Experiments—His First Line, with Cats for a Battery.[a]

What He Has Contributed to the World's Stock of Electrical Knowledge.[a]

Over Four Hundred Thousand Dollars Expended in Experiments.[a]

Written for The Chicago Tribune.

So much attention has recently been attracted to the inventions of Thomas A. Edison, that the facts concerning this remarkable man may be found interesting. It is a matter of pride with him that he is a full-blooded American. His ancestry on the father's side can be traced back 200 years, when they were extensive millers in Holland. In 1730 members of the family emigrated to this country. Thomas Edison was a prominent bank official on Manhattan Island during the Revolution, and his name appears on the Continental money. The race is long-lived. Edison's great-grandfather lived to be 102, and his grandfather to be 103 years old. His father, Samuel Edison, is now living, aged 74, and in perfect health. He stands six feet two inches, and in 1868 outjumped 250 men belonging to a regiment stationed at Ft. Gratiot, Mich. He learned the tailor's trade, but subsequently entered commercial life, and engaged consecutively in the grain, commission, lumber, nursery, and land business. He has always been in comfortable circumstances. Edison's mother, Mary Elliot Edison, was of Scotch parentage, but born in Massachusetts. She was finely educated, and for several years taught in a Canadian high school. She was an industrious, capable, literary, and ambitious woman. She died in 1862 at 67 years of age. Thomas Alva Edison was born Feb. 11, 1847, at Milan, Erie County, Ohio. This was then a thriving town of several thousand inhabitants. Located at the head of the Milan Canal four miles from Lake Erie, it was the centre of the ship-building, wheat-shipping, and stave-making interests of that region. Exhaustion of the surrounding timber, and the construction of the Lake Shore Railroad some distance south of the town, brought about decay, which compelled Edison's parents to remove to Port Huron, Mich., when he was 7 years old, which has since been their home. Edison never went to school over two months in his life. His mother taught him spelling, reading, writing, and arithmetic. She was a fine reader, and often read aloud to the family. Edison acquired his love of reading from her, which was encouraged by his father, who paid him for each book mastered. At 10 years old he had read "The Penny Encyclopedia," Hume's History of England, History of the Reformation, Gibbons's Rome, Searl's History of the World, several works on chemistry, and other similar works. He read them all with the utmost fidelity, never skipping a word or a formula, although mathematics were and are especially repulsive to him. It is this habit of concentration which has led him to the accomplishment of many astonishing results. As a boy, he was always occupied, and amused himself making plank roads, digging caves, and trying experiments, his mind being full of subjects. He was uneasy to get into business, and at 12 years of age his father secured him a place as train-boy on the Grand Trunk Railroad. When the road was completed between Detroit and Port Huron, he acquired an exclusive newsdealer's right, having as high as four assistants. During the four years he ran the road, his earnings averaged a dollar a day, which was given to his mother. In commencing to visit Detroit he joined the library, and started to read it through. He began on the bottom shelf, and read every book for fifteen feet, when the job was given up as hopeless, and thereafter congenial selections were made. He was an occasional reader of fiction and poetry. Victor Hugo is his favorite author. The "Les Miserables" he read a dozen times, and has reviewed it as often since. "The Toilers of the Sea" he considers a grand book. His memory is so retentive that he can quote extensive extracts from many sources, and can usually refer direct to the book and page of his scientific library for any fact or information needed for experiment or research. His mind is crammed with an immense mass of information, it being difficult to mention a subject about which he knows nothing. He has a partial knowledge[b] of the French, German, Italian, and Spanish languages. Attached to the mixed train upon which he sold papers was a freight-car having a room partitioned off for smoking purposes. As the car was without springs or ventilation, no one would ride in it. Edison obtained "Tresenius' Quality of Analysis," bought some chemicals on the installment plan, induced the hands at the railroad shop to make him some retort stands in exchange for papers, and turned the smoking-room into a laboratory. The Detroit *Free Press,* then owned by Wilbur F. Storey, came out in a new dress. Edison purchased 300 pounds of old type, and for six months published a weekly paper on the train called the Grand Trunk Herald. The price was 3 cents, and the subscription list ran up to several hundred. It was printed on one side only, by hand, and was devoted to railroad gossip, changes, accidents, and information. George Stephenson, the English engineer, who built the tubular bridge at Montreal, when passing over the road, found Edison at work, and ordered an extra edition for himself. The paper was afterwards noticed by the London *Times.* One day the water in Edison's phosphorus bottle evaporated, it fell on the floor, and ignited the car. The conductor with difficulty extinguished the fire, threw the materials out of the car, and gave Edison a threshing, so that his newspaper and laboratory came to a sudden end. He continued his experiments in the cellar at home, and carried his printer's material with him for several years.

While running into Detroit he became acquainted with the telegraph operators, and in hanging about the office the idea suggested itself to telegraph the newspaper headings to the stations in advance of the train. The effect was to spread the information of the battles then taking place and greatly increase his sales. The success taught him the value of the telegraph, and he determined to learn the business. He purchased a work on the electric telegraph, and, in conjunction with James Ward, one of his assistants, they constructed a telegraph line between their residences in Port Huron. They used common stove-pipe wire insulated with bottles placed on nails driven into trees and crossed under an exposed road by means of a piece of abandoned cable, captured from the Detroit River. The first magnets used were made with wire wound with rags for insulation, and a piece of spring brass was used for a key. They were somewhat mixed as to the relative value of dynamic and static electricity for telegraph purposes, and the first attempt to generate a current was by means of a couple of cats rubbed vigorously at each end at an appointed time. This effort proved a failure, although they succeeded in getting rid of the cats with lightning-like rapidity. Soon after this experiment, some old telegraph-instruments and battery-materials were purchased, and a successful short line was inaugurated. This was quite an achievement in those days, although now there are hundreds of such short lines throughout the country.

About two months afterward, as the railroad train was switching some cars on to the side track at Mt. Clements Station, the agent's little boy, two years old, crept upon the track in front of the approaching cars. Edison, seeing the danger, sprang to the ground, seized the child, and barely saved his life. J. A. McKenzie was the agent and operator, and in gratitude for the act volunteered to assist Edison to learn telegraphy. Thereafter, on reaching the end of his route, Edison would go back by freight-train to Mt. Clements, and worked nights to perfect himself in operating. In five months[c] he was sufficiently advanced to secure employment in the telegraph office at Port Huron. The office was in a jewelry store, and Edison had an opportunity to indulge his mechanical inclinations. He worked night and day to improve himself, but resigned in six months because compensation promised for extra work was withheld. His regular salary was $25 a month.

He next went to Stratford, Canada, as night operator. The operators were required to report "six" every half hour to the Circuit Manager. Edison indulged his ingenuity to a bad purpose by making a wheel with Morse characters cut in the circumference in such a way that when turned it would write the figure six, and sign his office-call. This the watchman turned for him while Edison slept.

His stay at this point was brief. One night the dispatcher sent an order to hold a train. Edison repeated back the message before showing it to the conductor. When he ran out for the purpose the train had pulled off from the side track and was gone. When the dispatcher was notified, the opposing train was beyond reach. Fortunately the two trains met on a straight track, and no accident happened. The railroad Superintendent sent for Edison and so frightened him with threats of imprisonment that, without getting his wardrobe, he started for home, and was greatly delighted to reach his native land. He spent a few weeks at Port Huron in study, but operators were in demand, and he obtained a situation at Adrian, Mich. Here he had a small shop and a few tools, where his spare time was used in repairing instruments and making such experiments as he had the means to accomplish. It was then a peculiarity of the Morse telegraph system that only one message at a time could be sent on a wire at the same time. It is also a characteristic of young operators, that each considers himself the most important personage on the line, and that his business must go first. Being at safe distances operators fling the most violent abuse at each other with impunity, and meanwhile messages wait. Edison proved no exception to the rule, and on one occasion when he had some message from the Superintendent insisted on taking the line from all comers. The Superintendent of Telegraph lived in the same town and had an instrument in his house. Hearing the tussel on the wire, he rushed to the office, pounced upon Edison, and discharged him for violation of rules.

His next situation was in night service at Fort Wayne, and in two months he had improved so as to secure a situation at Indianapolis. Here he invented his first successful automatic repeater, which is an arrangement for transferring the writing from one telegraph line to another without the medium of a sending or receiving operator. It was an important achievement for so young and inexperienced an operator.

The ambition of all operators is to be able to take "press report." Edison practiced nights incessantly to accomplish this end. He was finally given a trial, but finding himself making too many breaks or interrogations he rigged two more recording registers, one to receive and one to repeat the embossed writing at slower speed so it could be copied. When this was done he told the sending operator to "rush him," which gave him a brief reputation, for the "copy" was so slow in reaching the press it caused complaint, and he was suspended from the work.

At the end of six months he was transferred to Cincinnati. Here he worked a day wire, but continued to practice nights and "subbed" for the night men whenever he could get the privilege.

He had been in Cincinnati three months when a delegation of Cleveland operators came down to organize a branch of the Telegraphers' Union, which resulted in the great strike a few years since. They struck the office in the evening, and the whole force, with one exception, went off on a gigantic spree. Edison came round as usual to practice, and finding the office so nearly deserted took the press report to the best of his ability, and worked through the night, clearing up business. The following day he was rewarded by an increase of salary, from $65 to $105 per month, and was given the Louisville wire, one of the most desirable in the office. Bob Martin, one of the fastest senders in the country, worked the Louisville end, and from the experience here acquired, Edison dates his ability as a first-class operator.

Edison's utter negligence of dress and appearance, his willingness to work at all hours, night or day, his unsatiable thirst for reading, and his enthusiastic attempts to solve what appeared to his companions impossibilities, earned for him the name of "luny" or crazy man, which clung to him a number of years. He retained, however, the personal good will of his associates.

In 1864 he went to Memphis and obtained a more remunerative salary. His associates were dissolute and imposed upon his good nature to such an extent that the work he did was enormous. Abstemious himself almost to stoicism, he freely loaned his money to his companions or expended it in the purchase of books and apparatus. He made and put into operation his automatic repeater, so that Louisville and New Orleans could work direct. The idea of duplex transmission[d] had taken possession of him, and he was perpetually advocating and experimenting to accomplish it. These efforts were looked upon with disfavor by the management, and in the changes resulting upon the transfer of the lines from the Government to the Telegraph Company he was dismissed.

Being without money, and having transportation to Decatur only, he walked to Nashville, where Billy Foley, an operator in the same predicament, was found, and they traveled together to Louisville. Edison had only a linen suit, and on arriving at Louisville he found the weather extremely chilly. He hunted up a friend who loaned him money for his immediate need. Foley's reputation was too bad to obtain a situation himself, but he recommended Edison, who obtained work. For this service Edison supported Foley till he could get a job.

Edison describes the Louisville office at this time as the dirtiest and most free and easy in the business. The common disposition of tobacco-quids was to hurl them at the ceiling, where they stuck by the hundred. Rats in great numbers kept the operator company at night. The discipline was lax in all things except the quality and promptness of work. Edison was required to take reports on a line worked from the blind side of a repeater, where he had no chance to break. This required skill, and he attained to a rare perfection by the most careful study of names, markets, and general information. The line was old and in poor condition, being subject to many interruptions and changes. To assist in his work, Edison was in the habit of arranging three sets of instruments, each with a different adjustment, so that, whether the circuit was strong or weak, or no matter how rapid the change, he was able to receive the signals accurately. He remained in Louisville for nearly two years, and then got the South American fever. In connection with Messrs. Keen and Warren, two of his associates, he saved money for the trip, and they started, intending to go via New Orleans. On arriving at the latter place, the vessel upon which they were to ship had fortunately sailed. Edison fell in with a Spaniard who had traveled round the world. He told him of all the countries visited the United States was the best, having the most desirable Government, institutions, climate, and people. This wholesome advice shook Edison's determination in connection with his disappointment at delay, and he resolved to go home. He went to Port Huron via the Gulf and Atlantic States. After remaining a few weeks he again got work at Louisville, and returned there. He now began to save his earnings more than ever, and invested them in additions to his library, apparatus, printing-office, and shop. He started to publish a work on electricity with his own office, but the task proved too much for his facilities. He went into a most elaborate series of experiments, as was his custom when investigating any subject, to determine the most rapid and best-adapted style of penmanship for an operator's use. He finally fixed upon a slightly back-hand, with regular round characters, isolating the letters from each other, and without shading. This beautiful penmanship he became able to produce at the speed of forty-five words per minute, which is the extreme limit of a Morse operator's ability to transmit. Edison's description of the habits of his associate operators at this time is amusing in the extreme. Often when he went home from his work in the small hours of the morning, he would find three of the boys on his bed with their boots, where they had crawled after an evening's dissipation. He would gently haul them out and deposit them on the floor, while he turned in to sleep. Meanwhile, the office was removed to a new building with improved fixtures, and the instruments were fastened to the tables. Orders were issued not to move the instruments. Edison, however, could not desist from taking three sets to connect up, so as to get report correctly, for the line outside had not improved. At one time he had every instrument in the office out and connected together to try an experiment.[c]

Beneath the office was a bank, and in the back office an elegant carpet covered the floor. Over this was the battery room, and one night, in trying to abstract some sulfuric acid for experiments, he tipped over the whole carboy. The acid ran through the floor and ceiling, destroying the carpet and doing other damage. This proved the climax of endurance, and Edison was discharged. He went immediately to Cincinnati, and obtained work as "report operator." This was the scene of some of his first achievements.[d] He always had a hankering for machinery, and when on the Grand Trunk Railway frequented the machine-shops, and learned to run an engine. On one occasion, when the engineer and fireman were exhausted from overwork and fell asleep, he ran a train nearly the entire trip. He unfortunately pumped the engine too full of water, so that it was thrown from the smoke-stack, and deluged the engine with filth, much to the discomfiture of the engineer, who had slept while Edison ran the train. In Cincinnati, on his first stay, he made an ingenious small steam-engine, and arranged his first duplex instruments. The instruments were very crude, as he had so little to work with, but the drawings, which still exist, show conclusively that double transmission was possible at a much earlier date than when put into practical use.

His second stay in Cincinnati was very unpopular on account of his continued experiments. He would get excused from duty, and take a bee-line to the Mechanics' Library, where his entire day and evening would be spent reading the most ponderous electrical and scientific works. He remained in Cincinnati only a short time, and returned home.

He had a warm personal friend, M. T. Adams, in the Boston office. An expert was needed to work a heavy New York wire. Several candidates had failed, as the New York end was worked by "York and Erie" operators, who, as a class, had the reputation of writing anything but the "Morse" alphabet. G. F. Milliken, the manager, offered the situation to Edison by telegraph, and he accepted. He started via the Grand Trunk, and the train was snowed in for two days near the bluffs of the St. Lawrence River by a violent storm. The passengers nearly perished with cold and hunger. When all resources for fuel and food were exhausted, a delegation was sent out to hunt for relief. They were gone so long, another expedition was about starting in search of them, when they returned and reported a hotel not far distant where cigars were one cent apiece, whisky three cents a glass, and board 50 cents a day. A shout of relief went up from the crowded cars, and they were soon comfortably housed till the storm was over. Edison finally reached Boston all right. His reception at the telegraph office, and the manner in which he so successfully overcame the prejudices inspired against him by his uncouth appearance, was described at length in THE TRIBUNE a few days ago. Although somewhat exaggerated, the account is substantially correct. The table at which he had been placed was in the centre of the room, for the better enjoyment of his discomfiture. He noticed the arrangement, and says he would have died rather than made a break. He arrived in Boston in 1868, and in the person of Mr. Milliken found the first superior officer who could appreciate his character.[f] Mr. Milliken was an accomplished gentleman, a thorough master of his profession, and an inventor of merit. He made allowance for the gawky and hungry look of his subordinate, and in the secret excitement under which he seemed to labor recognized the fire of genius. Edison's stay in Boston was congenial. There is a vein of humor running through his character, and he played a practical joke on the cockroaches, which infested the office in great numbers. He placed some narrow strips of tin-foil on the wall and connected them with the wires from a powerful battery. Then he placed food in an attractive manner to tempt them. When these clammy individuals pased from one foil to the other they completed the battery connection, and with a flash were cremated, to the delight of the spectators. Edison started a shop in Boston, and gave all his spare time to it. His ideas here began to assume practical shape. He invented a dial instrument for private line use, and put several into practical operation. He made a chemical vote-recording apparatus, but failed to get it adopted by a Massachusetts Legislature. He commenced his experiments on vibratory telegraph apparatus, and made trial tests between Boston and Portland. He matured his first private line printer, and put eight into practical operation. From lack of means to pay for quotations, his venture was not successful, and he sold out. This patent subsequently came into possession of the Gold and Stock Telegraph Company, and was considered to have a base or foundation value upon which many subsequent improvements were built.

At one time he was invited to explain the operation of the telegraph to what he supposed was a girl's school. He forgot the appointment, and when found was putting up a line on a house-top. He went directly from his work, and was much abashed to find himself ushered into the presence of a room full of finely-dressed young ladies. He was actually timid in ladies' presence, but his subject was understood, and the occasion passed pleasantly. He was introduced to a number of the young ladies, who always recognized him on the street, much to the astonishment of his fellow-operators not in the secret. Edison is a strong believer in the Boston girl.

His idea of a duplex system constantly burned in his brain, and in 1870 he went to Rochester, N.Y., to try his apparatus between the two cities. Mr. F. L. Pope, the present patent adviser of the Western Union Telegraph Company, assisted in New York. The effort was a failure, although Edison has always claimed it ought to have succeeded. He then went to New York, arriving there dead broke and discouraged. He hung around the office of the Gold Indicator Company for several days. Their apparatus was cumbersome and imperfect, and frequently out of order. At such times the brokers would rush to the office and demand instant repairs. One day when there was an unusual excitement in the gold market, the apparatus failed. The confusion at the Indicator office was great. The Superintendent was out. Edison happened in and stood watching the confusion. He volunteered to fix the machinery. The President looked upon him with amazement, but, being in the mood to catch at straws, gave him permission to try. He speedily found the defect, and the next day was engaged to fill a responsible position with the Company. He immediately began to improve the apparatus, and soon invented a gold printer. The Company was purchased by the Gold and Stock Company, and Edison was thrown out. He then went into company with Pope and Ashley (the latter now being editor of the *Journal of the Telegraph*). The Pope and Edison printer[8] was brought out, and a private line system was put in active operation. This was soon sold to the Gold and Stock Company, and Edison has for many years been retained in the service of that Company and the Western Union Telegraph Company at a large salary, they having the first option to purchase his inventions pertaining to telegraphy at prices agreed upon in each case. Edison's inventions pertaining to the gold and stock telegraphy soon replaced the old apparatus, and that system is interwoven with his inventions and improvements. At the formation of his intimate connection with the Gold and Stock Company he established an immense electrical manufacturing establishment at Newark, which was divided into three large shops and two laboratories for experiment. He employed upwards of 300 men, and was himself the busiest man in America. He gave himself scarcely any time for sleep. An idea of his determination and persistence can be gained from the following incident: He had been given an order for $30,000 worth of improved printers. The sample instrument had worked an experimental circuit, but the first instruments for practical use proved a failure. In vain he sought to remedy the defect, till finally, taking four or five of his best men, he went to the top floor of his factory, remarking that they would never come down till the printer worked. They labored continuously for sixty hours, and he was so fortunate as to discover the fault, and made the printers operate perfectly at an expense of $5,000. Such severe and protracted labors are common with him. He says after going without sleep more than the ordinary hours he becomes nervous, and the ideas flow in upon him with great rapidity. His sleep after these efforts is correspondingly long, sometimes lasting thirty to thirty-six hours. He knows no such division as day and night in his labors, and, when the inspiration is upon him, pursues the investigation and experiment to the end. As a manufacturer he did not prove a success. The more resources at command, the greater his efforts at invention. At one time he had forty-five distinct inventions and improvements under way. All the large sums received for his patents and the profits arising from manufacturing to the amount of nearly $400,000 have been expended in inventive efforts. He finally became excessively annoyed at the tax upon his powers arising from regular business, and concluded to remove to some small place inconvenient to reach, where he would be free from curiosity-seekers, and have opportunity to put into practical shape his conceptions. In 1876 he sold his machinery, and moved his family to Menlo Park, N.J., on the Pennsylvania Railroad, twenty-four miles from New York. Here, on the crest of a hill, remote from other buildings, he built a laboratory 28 x 100 feet, two stories in height. In one room on the ground floor he has a machinery apartment, in which is located a ten-horse-power engine, and a collection of expensive tools, so that any appliance, however intricate, can be made under his own inspection. In another room are ranged on shelves and in cases the models of a large number of his experiments and inventions. Here are also to be found many instruments of precision which he has purchased at great cost to assist in his investigations. His library is entirely scientific, and costly, but not large. On his upper floor he has ranged upon shelves thousands of bottles of chemicals, and he makes it a rule to purchase some of every known chemical or mineral, to have at hand in case of need. Here he conducts his experiments under his personal supervision. He has always with him three or four assistants, whom he has selected on account of their skill as draughtsmen or workmen, willingness to comply with his wishes, and their physical endurance, which, with him, is an important consideration. Messrs. Charles Batchelor, Scotch, and James Adams, Irish, and Mr. Kusel, of German descent, are the principal assistants. Sometimes he has fifteen men employed exclusively in developing his inventions, if of importance and near completion. Edison was described by the United States Patent Commissioner as the young man who has kept the path to the Patent Office hot with his footsteps.[h] He has been granted 112 patents in this country, and has some twenty applications pending in the office. His most valuable inventions have been patented in many foreign countries. Of his American patents, thirty-five pertain to automatic and chemical telegraphs, eight to duplex and quadruplex telegraphy, thirty-eight to printing telegraph instruments, fourteen to Morse telegraph apparatus proper, and the remainder relate to fire-alarms, district and domestic telegraphy, electric signals, the electric pen, the speaking phonograph, and a variety of electrical and non-electric apparatus.

The printing telegraph instruments, the automatic or chemical system, by which 1,000 words a minute can be transmitted on a single wire for medium distances; the quadruplex system, by which four messages at a time are sent on the same wire by the Morse method; the electric pen; the carbon telephone, which exceeds all others for its loudness and distinctness; the speaking phonograph, and the aerophone are among his most valuable productions.

He has made many extremely interesting and minor discoveries, such as the lubricating property of electricity upon which the electro motorgraph is based, and upon which could be built an entirely new system of telegraphy. His mind is so prolific that he can always afford to accept reasonable compensation for his inventions.

He is sharp at a bargain, and has been styled a Tallyrand in negotiating for the disposition of his inventions. His peculiarities and the great value of his inventions have led to severe struggles for the possession of some of them. His great anxiety seems to be to give an equivalent invention for the price asked, but he professes to be utterly without conscience in case of any attempt to overreach him. In person he is five feet nine and one-half inches tall; he wears a seven and seven-eighths inch tall hat; his hair is black and worn short and is slightly gray. His complexion is pale and fair, his eyes are gray and piercing; he has a sharp nose and countenance. When in application his look is most intense, although there is often a merry twinkle in his eye. His chest expansion is five inches. His powers of application, patience, and endurance are something wonderful. He begins where most people leave off, and, like a Morphy at chess, carries on five or six lines of experiment in totally different divisions, never ceasing any of them till a result is reached or an impossibility proved. He keeps a careful record of each day's experiments, properly witnessed, and has numerous volumes of such statistics. He is quite hard of hearing, and his accomplishments with the telephone are most remarkable on account of this defect. For a long time he was unable to distinguish the sound produced, and depended on his assistants. He many times despaired of a result. At last he got his carbon telephone sufficiently loud so that he could hear it over long distances without difficulty, and was satisfied. That such a man should go on and eliminate the speaking phonograph is surprising, and, in view of his defect, he may almost be forgiven the production of the aerophone, intended to talk from three to ten miles. He was married to Miss Mary

Stillwell, of Newark, in 1873. The medallion on the new silver dollar is an excellent profile likeness of her. Their honeymoon was eccentric, as Edison, although in the same city, could not leave his work for more than a few hours two or three times a week, the remainder of his time being used at his factory. The influence of his wife has greatly improved his habits and appearance of recent years. They have two children,—a little girl 5 years and a boy 2 years old,—who are nick-named "dot" and "dash," after the characters in the Morse alphabet. He is affectionate and generous in his family but rides rough shod[i] over the ordinary mannerisms of life, and gets down to what he calls solid business. He has a large and comfortable residence near his laboratory. He says the existence of a God can be demonstrated in a thousand ways to an absolute certainty, but he has no religious convictions in the ordinary sense. His attention has heretofore been largely turned to electricity, but his knowledge extends over a wide field. He feels confident of being able to produce one or two things equally good as the quadruplex, telephone, electric pen, or phonograph, a year. He fully expects to live to the age of the oldest member of his family, in which case, if the public desire a relief from his inventions, the only way will be to hang him, as the *New York Times* suggests, for prevention. His income from his inventions the present year will probably reach $50,000, all of which will undoubtedly be spent in pushing his inventions to completion. His personal tastes are very simple. When invited to dine recently at Delmonico's, he satisfied himself with a piece of pie and cup of tea, greatly to the astonishment of his host, who wanted to do the handsome thing. When tendered a public dinner he declined, stating that $100,000 would not induce him to sit through two hours of personal glorification. He dislikes personal notoriety, and says a man is to be measured by what he does, and not by what is said of him.

When a success is reached, it rapidly loses interest for him, and he must find some fresh impossibility upon which to expend the fuel of his genius, and burn out his life.

Where can an example be found who has done more in his own sphere than Thomas A. Edison to promote knowledge and bring the secrets of Nature under the useful control of his fellow-men?

GEORGE H. BLISS.

PD, *Chicago Tribune*, 8 April 1878, 3. In Scraps., Cat. 1031:101 (*TAEM* 27:795). [a]Followed by centered horizontal line. [b]"He . . . knowledge" centered and printed in full capital letters. [c]"In five months" centered and printed in full capital letters. [d]"duplex transmission" centered and printed in full capital letters. [e]"try an experiment" centered and printed in full capital letters. [f]"could . . . character." centered and printed in full capital letters. [g]"The . . . printer" centered and printed in full capital letters. [h]"hot . . . footsteps." centered and printed in full capital letters. [i]"rides rough shod" centered and printed in full capital letters.

Appendix 4

Edison's U.S. Patents, 1878

The following list contains all patents for which Edison executed an application in the period covered by Volume Four. It is arranged in chronological order by execution date, which is the date on which Edison signed the application and the date in the patenting process that comes closest to the time of actual inventive activity. The application date is the date on which the Patent Office received and recorded the application. The case numbering system, which Edison used throughout his career, seems to have originated in Lemuel Serrell's office as a means of ordering Edison's applications as they arrived. The full Patent Office files containing each original application, any amendments, and related correspondence are at MdSuFR. Edison's American patents from this period are in *TAEM* 1–2; British patents are in Cat. 1321, Batchelor (*TAEM* 92:78–117).

	Exec. Date	*Appl. Date*	*Issue Date*	*Pat. No.*	*Case No.*	*Title*
143.	02/13/78	02/21/78	04/30/78	203,019	150	Circuits for Acoustic or Telephonic Telegraphs
144.	02/28/78	03/04/78	03/26/78	201,760	153	Speaking-Machines
145.	02/28/78	03/04/78	04/30/78	203,017	152	Telephone Call-Signal
146.	02/28/78	03/07/78	04/30/78	203,016	151	Speaking-Telephones
147.	08/31/78	11/27/78	12/10/78	210,767	*	Vocal Engines
148.	10/05/78	10/14/78	04/22/79	214,636	156	Electric Lights
149.	11/08/78	11/11/78	12/09/79	222,390	161	Carbon-Telephones
150.	11/11/78	11/14/78	07/22/79	217,782	160	Duplex Telegraphs

*This patent application apparently did not have a Case Number because it was handled by Uriah Painter rather than Lemuel Serrell.

151.	11/14/78	11/18/78	04/22/79	214,637	162	Thermal Regulators for Electric Lights
152.	12/03/78	12/09/78	08/05/79	218,166	165	Magneto-Electric Machines
153.	12/03/78	12/09/78	08/26/79	218,866	163	Electric Lighting Apparatus
154.	12/03/78	12/09/78	09/16/79	219,628	164	Electric Lights
155.	12/04/78	12/09/78	04/01/84	295,990	167	Type-Writer
156.	12/31/78	01/10/79	08/05/79	218,167	168	Apparatus for Electric Lights

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Bibliography

Altick, Richard D. 1978. *The Shows of London.* Cambridge, Mass., and London: Harvard University Press.

Atkinson, E., trans. and ed. 1886. *Elementary Treatise on Physics, Experimental and Applied.* From *Ganot's Eléments de Physique.* 12th ed. New York: William Wood and Co.

———. trans. and ed. 1890. *Elementary Treatise on Physics, Experimental and Applied.* From *Ganot's Eléments de Physique.* 13th ed. New York: William Wood and Co.

Avery, Elroy M. 1885. *Elements of Natural Philosophy.* New York and Chicago: Sheldon & Co.

Ayres, Brown. 1878. "The Telephone." *J. Franklin Inst.* 105:378–93.

Bailey, Chris H. n.d. "The Ansonia Clock Company." In files of the Old Derby Historical Society, Derby, Conn.

Baker, Edward C. 1976. *Sir William Preece, F.R.S.: Victorian Engineer Extraordinary.* London: Hutchinson & Co.

Baldwin, F. G. C. 1925. *The History of the Telephone in the United Kingdom.* London: Chapman & Hall, Ltd., and New York: D. Van Nostrand Company.

Barker, George F. 1879. "On the Results of the Spectroscopic Observation of the Solar Eclipse of July 29th, 1878." *Am. J. Sci.* 3d ser. 17:121–25.

Barrett, William F. 1878a. "Early Electric Telephony." *Nature* 17: 510–12.

———. 1878b. "Speaking Machines II." *Good Words* 19:560–64. In Cat. 1032:129, Scraps. (*TAEM* 27:918).

———. 1878c. "The Microphone." *Good Words* 19:711–16.

———. 1878d. "The Telephone, Its History and Recent Improvements III." *Nature* 18:56–59. In Cat. 1240, item 1034, Batchelor (*TAEM* 94:425).

Bender, Thomas. 1987. *New York Intellect: A History of Intellectual Life in New York City, from 1750 to the Beginnings of Our Own Time.* New York: Alfred A. Knopf.

Bishop, William H. 1878. "A Night with Edison." *Scribner's Monthly* 17:88–99.

Black, Henry Campbell. 1968. *Black's Law Dictionary: Definitions of the Terms and Phrases of American and English Jurisprudence, Ancient and Modern.* St. Paul: West Publishing Co.

Blake, Clarence J. 1879. "The Graphic and Photographic Illustration of Sound-Waves. I." *American Journal of Otology.* 1:3–9.

Blavatsky, Helena Petrovna. 1972 [1877]. *Isis Unveiled.* Wheaton, Ill.: Theosophical Publishing House.

Blodget, Lorin, and Edwin T. Freedley. 1885. *Philadelphia and Its Industries.* Philadelphia: Gelwicks & Story.

Bloxam, Charles Loudon. 1873. *Chemistry, Inorganic and Organic: With Experiments.* Philadelphia: Henry C. Lea.

Boston: Its Commerce, Finance and Literature. 1892. New York: The A. F. Parsons Publishing Co.

Bowers, Brian. 1982. *A History of Electric Light and Power.* Stevenage, UK: Peter Peregrinus Ltd.

Braden, Donna R. 1983. "Sarah Jordan's Boarding House: Research Report." Unpublished manuscript, MiDbEI.

Bradley, Leverett. 1872. *Apparatus for Electric Measurement, with Rules and Directions for its Practical Application.* Jersey City, N.J.: L. Bradley.

Bright, Arthur A. 1972 [1949]. *The Electric-Lamp Industry: Technological Change and Economic Development from 1800 to 1947.* New York: Arno Press.

Browne, Junius Henri. 1869. *The Great Metropolis, A Mirror of New York.* Hartford: American Publishing Co.

Bruce, Robert V. 1973. *Bell: Alexander Graham Bell and the Conquest of Solitude.* Boston: Little, Brown & Co.

Brush, Stephen G. 1978. *The Temperature of History.* New York: Burt Franklin & Co.

Bryant, Lynwood. 1967. "The Beginnings of the Internal Combustion Engine." In *Technology in Western Civilization* Vol. 1, ed. by Melvin Kranzberg and Carroll Pursell. New York: Oxford University Press.

Butler, Samuel. 1877. *Life and Habit.* London: A. C. Fifield.

Butrica, Andrew J. 1986. "From *Inspecteur* to *Ingenieur:* Telegraphy and the Genesis of Electrical Engineering in France, 1845–1881." Ph.D. diss., Iowa State University.

Campbell, Bruce F. 1980. *Ancient Wisdom Revived: A History of the Theosophical Movement.* Berkeley: University of California Press.

Chew, V. K. 1981. *Talking Machines.* London: HMSO.

Carlson, W. Bernard. 1991. *Innovation as a Social Process: Elihu Thomson and the Rise of General Electric, 1870–1900.* Cambridge: Cambridge University Press.

Carosso, Vincent P. 1987. *The Morgans: Private International Bankers 1854–1913.* Cambridge, Mass.: Harvard University Press.

Carpenter, William Benjamin. 1877. *Principles of Mental Physiology, with their applications to the training and discipline of the mind, and the study of its morbid conditions.* New York: D. Appleton and Co.

Charbon, Paul. 1981. *La Machine parlante.* Paris: Jean-Pierre Gyss.

Christopher, Milbourne. 1973. *The Illustrated History of Magic.* New York: Thomas Crowell.

Clark, Josiah Latimer, and Robert Sabine. 1871. *Electrical Tables and Formulae.* London: E. & F. N. Spon.

Cohen, Daniel. 1982. *The Last Hundred Years: Household Technology.* New York: Evans & Co.

Cranston, Sylvia. 1993. *HPB: The Extraordinary Life and Influence of Helena Blavatsky, Founder of the Modern Theosophical Movement.* New York: G. P. Putnam's Sons.

Crosland, Maurice. 1992. *Science under Control: The French Academy of Sciences 1795–1914.* Cambridge: Cambridge University Press.

Culver, Roger B., and Phillip A. Ianna. 1979. *The Gemini Syndrome.* Tucson: Pachart Publishing House.

Curtis, S. J., and M. E. A. Boultwood. 1966. *An Introductory History of English Education Since 1800.* 4th ed. London: University Tutorial Press Ltd.

Dallas, Sandra. 1985. *Colorado Ghost Towns and Mining Camps.* Norman: University of Oklahoma Press.

Darwin, Charles. 1875. *The Movements and Habits of Climbing Plants.* Rev. ed. London: J. Murray.

de Clercq, P. R., ed. 1985. *Nineteenth-Century Scientific Instruments and their Makers.* Amsterdam: Rodopi.

Doerflinger, William. 1977. *The Magic Catalogue.* New York: E. P. Dutton.

Dredge, James. 1882–85. *Electric Illumination.* 2 vols. London: Engineering.

Drepperd, Carl W. 1958. *American Clocks & Clockmakers.* Enl. [2d] ed. Boston: Charles T. Branford Co.

Du Moncel, Theodose. 1974 [1879]. *The Telephone, the Microphone, and the Phonograph.* New York: Arno Press.

Duijker, H. C. J., and N. H. Frijda. 1960. *National Character and National Stereotypes.* Amsterdam: North-Holland Publishing Co.

Dunn, J. P. 1886. *Massacres of the Mountains: A History of the Indian Wars of the Far West.* New York: Harper and Brothers.

Dyer, Frank, and T. C. Martin. 1910. *Edison: His Life and Inventions.* 2 vols. New York: Harper & Bros.

Eddy, John A. 1972. "Thomas Edison and Infra-Red Astronomy." *Journal for the History of Astronomy* 3:165–87.

Edison, Thomas A. 1880. "On a Resonant Tuning Fork." *AAAS Proceedings* 28:178.

———. 1925. "Introduction." In *The Life and Works of Thomas Paine,* ed. William M. Van der Weyde. New Rochelle, N.Y.: Thomas Paine National Historical Association.

———. 1948. *The Diary and Sundry Observations of Thomas A. Edison,* ed. Dagobert D. Runes. New York: Philosophical Library.

Edison, Thomas A., and Edward H. Johnson. 1878. "The Future of the Phonograph." *The North American Review* 126:527–36.

Edison, Thomas A., and Francis Upton. 1880. "The Success of the Electric Light." *North American Review* 131:295–300.

Edwards, Paul, ed. 1967. *Encyclopedia of Philosophy.* New York: Macmillan Publishing Co., Inc.

Edwards, Samuel. 1977. *The Vidocq Dossier.* Boston: Houghton Mifflin.

Elliott, Russell R. 1973. *History of Nevada.* Lincoln: University of Nebraska.

Fagen, M. D., ed. 1975. *A History of Engineering and Science in the Bell System: The Early Years (1875–1925).* n.p.: Bell Telephone Laboratories, Inc.

Faraday, Michael. 1859. *Experimental Researches in Chemistry and Physics.* London: Richard Taylor and William Francis.

———. 1965 [1839–55]. *Experimental Researches in Electricity.* 3 vols. bound as 2. New York: Dover Publications.

Farmer, John S., and W. E. Henley, comps. and eds. 1970 [1890–1904]. *Slang and Its Analogues.* New York: Arno Press.

Feldenkirchen, Wilfried. 1994. *Werner von Siemens: Inventor and International Entrepreneur.* Columbus: Ohio State University Press.

Ford, William F. 1874. *The Industrial Interests of Newark, N.J.* New York: Van Arsdale & Co.

Fossett, Frank. 1880. *Colorado: Its Gold and Silver Mines, Farms and Stock Ranges, and Health and Pleasure Resorts.* 2d ed. New York: C. G. Crawford.

Friedel, Robert, and Paul Israel. 1986. *Edison's Electric Light: Biography of an Invention.* New Brunswick, N.J.: Rutgers University Press.

Frost, Lawrence A. 1969. *The Edison Album: A Pictorial Biography of Thomas Alva Edison.* Seattle: Superior Publishing Co.

Gábor, Luca, ed. 1993. *Telephonic News Dispenser.* Budapest: Hungarian Broadcasting Co.

Gibbs, C. R. Vernon. 1957. *Passenger Liners of the Western Ocean.* 2d ed. London: Staples.

Gomes, Michael. 1994. *Theosophy in the Nineteenth Century: An Annotated Bibliography.* New York: Garland.

Gorman, Michael E. et al. 1993. "Alexander Graham Bell, Elisha Gray and the Speaking Telegraph: A Cognitive Comparison." *History of Technology.* 15:1–56.

Gossett, Thomas F. 1963. *Race: the History of an Idea in America.* Dallas: Southern Methodist University Press.

Gould's St. Louis Directory. (Printed annually.) St. Louis: David B. Gould.

Gray, Elisha. 1977 [1878]. "Experimental Researches in Electro-Harmonic Telegraphy and Telephony." In *The Telephone: An Historical Anthology,* ed. George Shiers. New York: Arno Press.

Gregory, Frederick. 1977. *Scientific Materialism in Nineteenth Century Germany.* Dordrecht and Boston: D. Reidel Publishing Co.

Gudde, Erwin G. 1969. *California Place Names: The Origin and Etymology of Current Geographical Names.* Berkeley and Los Angeles: University of California Press.

Haller, John S. Jr. 1971. *Outcasts from Evolution: Scientific Attitudes of Racial Inferiority.* Urbana, Ill.: University of Illinois Press.

Hankins, Thomas J. and Robert J. Silverman. 1995. *Instruments and the Imagination.* Princeton: Princeton University Press.

Heaviside, Oliver. 1876. "On the Extra Current." *Philosophical Magazine and Journal of Science.* 5th ser. 2:135–45.

Higham, John. 1970. *Strangers in the Land: Patterns of American Nativism, 1860–1925.* New York: Atheneum Publishers.

History of St. Clair County, Michigan. 1883. Chicago: A. T. Andreas and Co.

Holbrook's Newark City Directory. (Printed annually.) Newark. N.J.: A. Stephen Holbrook.

Holcombe, A. N. 1911. *Public Ownership of Telephones on the Continent of Europe.* Cambridge, Mass.: Harvard University Press.

Hounshell, David. 1975. "Elisha Gray and the Telephone: On the Disadvantages of Being an Expert." *Technology and Culture* 16: 133–61.

———. 1984. *From the American System to Mass Production, 1800–1932.* Baltimore and London: The Johns Hopkins University Press.

Houston, Edwin, and Elihu Thomson. 1878. "Report of the Committee on Dynamo-Electric Machines." *J. Franklin Inst.* 105:289–303, 363–78.

———. 1879. "Circumstances Influencing the Efficiency of Dynamo-Electric Machines." *Teleg. J. and Elec. Rev.* 7:25–26.

Howard, Bronson. 1941. *The Banker's Daughter, & Other Plays,* ed. Allan G. Halline. Princeton: Princeton University Press.

Hughes, David. 1878. "On the Action of the Sonorous Vibrations in Varying the Force of an Electric Current." *Engineering* 25:384–85.

Hulse, James W. 1978. *The Nevada Adventure: A History.* 4th ed. Reno: University of Nevada Press.

Hutchings, David W. 1978. "Francis Robbins Upton: The Silent Hero." Unpublished manuscript at Edison National Historic Site, West Orange, New Jersey.

Illustrated New York: The Metropolis of To-Day. 1888. New York: International Publishing Co.

Israel, Paul B. 1992. *From Machine Shop to Industrial Laboratory: Telegraphy and the Changing Context of American Invention, 1830–1920.* Baltimore and London: The Johns Hopkins University Press.

Israel, Paul, and Robert Rosenberg. 1991. "Patent Office Records as a Historical Source: The Case of Thomas Edison." *Technology and Culture* 32:1094–1101.

Jackson, Kenneth T. 1995. *The Encyclopedia of New York City.* New Haven: Yale University Press.

Jehl, Francis. 1937–41. *Menlo Park Reminiscences.* 3 vols. Dearborn, Mich.: Edison Institute.

Jenkin, Fleeming, and J. A. Ewing. 1878a. "Helmholtz's Vowel Theory and the Phonograph." *Nature* 17:384. In Cat. 1031:70, Scraps. (*TAEM* 27:773).

———. 1878b. "Letter to the Editor." *Nature* 17:423. In Cat. 1031:104, Scraps. (*TAEM* 27:797).

Jenks, William Lee. n.d. *History of Port Huron Street Railways.* William Lee Jenks Collection, MiD-B.

Johnson, Edward H. 1878. *Instructions for the Management and Operation of Edison's Speaking Phonograph.* Philadelphia: Burk & McFetridge. In PPC (*TAEM* 96:509).

Kieve, Jeffrey L. 1973. *The Electric Telegraph: A Social and Economic History.* Newton Abbot, UK: David & Charles.

King, W. James. 1962a. "The Development of Electrical Technology in the Nineteenth Century: 1. The Electrochemical Cell and the Electromagnet." *United States Museum Bulletin 228.* Washington, D.C.: Smithsonian Institution.

———. 1962b. "The Development of Electrical Technology in the Nineteenth Century: 2. The Telegraph and the Telephone." *United States Museum Bulletin 228.* Washington, D.C.: Smithsonian Institution.

———. 1962c. "The Development of Electrical Technology in the Nineteenth Century: 3. The Early Arc Light and Generator." *United States Museum Bulletin 228.* Washington, D.C.: Smithsonian Institution.

Kingsbury, J. E. 1915. *The Telephone and Telephone Exchanges: Their Invention and Development.* London: Longmans, Green, & Co.

———. 1916. "The Story of the Telephone." *The Electrician* 77:812–14.

Klein, Maury. 1986. *The Life and Legend of Jay Gould.* Baltimore and London: The Johns Hopkins University Press.

Knight, Edward H. 1876–77. *Knight's American Mechanical Dictionary.* 3 vols. New York: Hurd and Houghton.

Knight, Oliver. 1960. *Following the Indian Wars: The Story of Newspaper Correspondents Among the Indian Campaigners.* Norman, Okla.: University of Oklahoma Press.

Koenigsberg, Allen. 1987. "The First 'Hello!' Thomas Edison, the Phonograph and the Telephone." *Antique Phonograph Monthly.* 8:3–9.

Kottler, Malcolm Jay. 1974. "Alfred Russell Wallace, the Origin of Man, and Spiritualism." *Isis* 65:145–92.

Landes, David. 1983. *Revolution in Time.* Cambridge, Mass.: Harvard University Press.

Langley, Henry G., comp. 1878. *San Francisco Directory For the Year Commencing February, 1878.* San Francisco: Henry G. Langley.

Lubar, Steven. 1987. "Culture and Technological Design in the 19th-Century Pin Industry: John Howe and the Howe Manufacturing Company." *Technology and Culture* 28:253–82.

Lydenberg, Harry Miller. 1923. *History of the New York Public Library.* New York: New York Public Library.

MacLeod, Roy M., and James R. Friday. 1972. *Archives of British Men of Science.* London: Mansell.

Marsh, J. O., ed. 1980. *The Letters and Papers of David Edward Hughes (1831–1900), Part I.* Microfilm Archive for Victorian Technology, no. 1. Manchester, UK: Northwestern Museum of Science and Industry and Department of History of Science and Technology.

Marsh, J. O. and R. G. Roberts. 1979. "David Edward Hughes: Inventor, Engineer and Scientist." *Proceedings of the Institute of Electrical Engineers* 126:929–35.

Maver, William, Jr. 1892. *American Telegraphy: Systems, Apparatus, Operation.* New York: J. H. Bunnell & Co.

Mayer, Alfred Marshall. 1878a. "On Edison's Talking-Machine." *Pop. Sci. Mo.* 12:719–24.

———. 1878b. *Sound.* New York: D. Appleton and Company.

Mayr, Otto, and Robert C. Post, eds. 1981. *Yankee Enterprise: The Rise of the American System of Manufactures.* Washington, D.C.: Smithsonian Institution.

McCabe, James D., Jr. 1970 [1872]. *Lights and Shadows of New York Life; or, the Sights and Sensations of the Great City.* New York: Farrar, Straus and Giroux.

McDonald, Forrest. 1962. *Insull.* Chicago: University of Chicago Press.

McHugh, Jeanne. 1980. *Alexander Holley and the Makers of Steel.* Baltimore and London: The Johns Hopkins University Press.

Meadows, A. J. 1972. *Science and Controversy: A Biography of Sir Norman Lockyer.* London: Macmillan & Co.

Morton, Henry. 1879. "Lecture upon the Electric Light." *American Gaslight Journal* 30:2–7, 27–30, 51–54, 74–77. In *Edison Electric Light Co. v. U.S. Electric Light Co.*, 4068–83, Lit. (*TAEM* 48: 534–51).

Mulholland, John. 1935. *The Story of Magic.* New York: Loring & Mussey.

Niaudet, Alfred. 1884. *Elementary Treatise on Electric Batteries.* Translated by L. M. Fishback. New York: John Wiley & Sons.

Olcott, Henry Steel. 1895. *Old Diary Leaves: The True Story of the Theosophical Society.* New York: G. P. Putnam's Sons.

Paine, Thomas. 1967 [1894–96]. *The Works of Thomas Paine,* ed. Moncure Daniel Conway. New York: AMS Press.

Partridge, Eric. 1984. *A Dictionary of Slang and Unconventional English.* 8th ed. New York: Macmillan Publishing Co.

Passer, Harold C. 1972 [1953]. *The Electrical Manufacturers 1875–1900: A Study in Competition, Entrepreneurship, Technical Change, and Economic Growth.* New York: Arno Press.

Pauly, Phillip J. 1987. *Controlling Life.* New York: Oxford University Press.

Peck, William G. 1866. *Introductory Course of Natural Philosophy, Edited from Ganot's Popular Physics.* New York: A. S. Barnes & Co.

Pepper, John H. 1869. *The Playbook of Metals.* London: George Routledge and Sons.

Pickering, Thomas R. 1878. *Official Catalogue of the United States Exhibitors, Paris Universal Exposition 1878.* London: Chiswick Press.

Plush, Samuel M. 1878. "Edison's Carbon Telephone Transmitter, and the Speaking Phonograph." *J. Franklin Inst.* 105:266–71.

Pope, Franklin. 1872. *Modern Practice of the Electric Telegraph. A Handbook for Electricians and Operators.* 7th ed. New York: D. Van Nostrand.

Povey, P. J., and R. A. J. Earl. 1988. *Vintage Telephones of the World.* London: Peter Peregrinus Ltd. in association with the Science Museum.

Preece, William. 1877. "The Telephone." *Nature* 16:403–4. In Cat. 1240, item 246, Batchelor (*TAEM* 94:72).

———. 1878a. "On Some Physical Points Connected with the Telephone." *Proceedings of the Physical Society* 2:224–35.

———. 1878b. "The Phonograph." *Journal of the Society of Arts* 26:534–38. In Cat. 1029:82, Scraps. (*TAEM* 25:204).

———. 1878c. "Letter to the Editor." *Nature* 18:249. In Cat. 1032:78, Scraps. (*TAEM* 27:863).

Prescott, George B. 1877. *Electricity and the Electric Telegraph.* New York: D. Appleton and Co.

———. 1878a. "The Telephone and the Phonograph." *Scribner's Monthly* 15:848–58. In Cat. 1240, item 437, Batchelor (*TAEM* 94:133).

———. 1878b. "Edison's Carbon Telephone." *J. Teleg.* 11:114. In Cat. 1240, item 614, Batchelor (*TAEM* 94:204).

———. 1878c. *The Speaking Telephone, Talking Phonograph and other Novelties.* New York: D. Appleton & Co.

———. 1878d. "Recent Improvements in Telephony." *Scribner's Monthly* 16:600–2.

———. 1878e. "Recent Improvements in Telephony. The Microphone." *J. Teleg.* 11:225–26. In Cat. 1240, item 818, Batchelor (*TAEM* 94:315).

———. 1879. *The Speaking Telephone, Electric Light, and other Recent Electrical Inventions.* New York: D. Appleton and Co.

———. 1884. *Dynamo-Electricity: Its Generation, Application, Transmission, Storage and Measurement.* New York: D. Appleton & Co.

———. 1972 [1884]. *Bell's Electric Speaking Telephone: Its Invention, Construction, Application, Modification and History.* New York: Arno Press.

Reid, James D. 1879. *The Telegraph in America.* New York: Derby Bros.

———. 1886. *The Telegraph in America.* Rev. ed. New York: John Polhemus.

Rosenberg, Nathan, ed. 1969. *The American System of Manufactures.* Edinburgh: Edinburgh University Press.

Sabine, Robert. 1867. *The Electric Telegraph.* London: Virtue Bros. & Co.

Shaw, G. M. 1878. "Sketch of Edison." *Pop. Sci. Mo.* 13:487–91. In Cat. 1240, item 822, Batchelor (*TAEM* 94:319).

Simon, Maron J. 1971. *The Panama Affair.* New York: Charles Scribner's Sons.

Spencer, Herbert. 1898. *First Principles.* 4th ed. New York: D. Appleton & Co.

———. 1966 [1891]. *Essays: Scientific, Political, and Speculative.* Osnabrück, Germany: Otto Zeller.

Sprague, John T. 1878a. "The De Meritens Magneto-Electric Machine." *English Mechanic* 28:135. In Cat. 1241, item 996, Batchelor (*TAEM* 94:403).

———. 1878b. "The Electric Arc and Its Divisibility—1." *English Mechanic* 28:237–38. In Cat. 1241, item 1028, Batchelor (*TAEM* 94:422).

Tait, Peter Guthrie. 1876. *Lectures on Some Recent Advances in Physical Science with a Special Lecture on Force.* 2d ed. London: Macmillan & Co.

Taltavall, John B. 1893. *Telegraphers of Today.* New York: John B. Taltavall.

Taylor, A. J. P. 1971 [1954]. *The Struggle for Mastery in Europe, 1848–1918.* London, Oxford, New York: Oxford University Press.

Taylor, Joeclyn Pierson. 1978. *Grosvenor Porter Lowrey.* New York: Privately printed.

Thompson, Silvanus P. 1886. *Dynamo-Electric Machinery: A Manual for Students of Electrotechnics.* London: E. & F. N. Spon.

———. 1902. *Dynamo-Electric Machinery: A Manual for Students of Electrotechnics.* 8th American ed. New York: M. Strong.

———. 1905. *Design of Dynamos.* New York: Spon & Chamberlain.

———. 1910. *Light: Visible and Invisible.* 2d ed. London: Macmillan and Co.

Tosiello, Rosario J. 1979 [1971]. *The Birth and Early Years of the Bell Telephone System, 1876–1880.* New York: Arno Press.

Toulmin, Stephen, and June Goodfield. 1977 [1962]. *The Architecture of Matter.* Chicago and London: University of Chicago Press.

Trachtenberg, Alan. 1989. *Reading American Photographs: Images as History, Mathew Brady to Walker Evans.* New York: Hill and Wang.

Tritton, Paul. 1993. *The Godfather of Rolls-Royce: The Life and Times of Henry Edmunds, M.I.C.E., M.I.E.E., Science and Technology's Forgotten Pioneer.* London: Academy Books.

Turner, Gerard L'Estrange. 1983. *Nineteenth-Century Scientific Instruments.* London: Sotheby Publications, and Berkeley: University of California Press.

U.S. Bureau of the Census. 1970. *Population Schedules of the Tenth Census of the United States, 1880. National Archives Microfilm Publications Microcopy No. T9.* Washington, D.C.: National Archives.

U.S. Patent Office. 1882. *Index of Patents Relating to Electricity granted by the United States prior to July 1881.* Washington, D.C.: GPO.

U.S. Senate. 1885. *Report of the Committee of the Senate upon the Relations Between Capital and Labor.* 5 vols. Washington, D.C.: GPO.

Wasserman, Neil H. 1985. *From Invention to Innovation: Long-Distance Telephone Transmissions at the Turn of the Century.* Baltimore and London: The Johns Hopkins University Press.

Watts, Henry. 1875. *A Dictionary of Chemistry and the Allied Branches of other Sciences.* London: Longmans, Green, and Company.

Western Union Telegraph Co. (Printed annually). *Annual Reports.* New York: Western Union Telegraph Co.

White, Andrew Dickson. 1905 *Autobiography of Andrew D. White.* New York: Century Co.

Whitehill, Walter Muir. 1968. *Boston: A Topographical History.* 2d ed. Cambridge: Harvard University Press.

Wile, Frederic William. 1974 [1926]. *Emile Berliner: Maker of the Microphone.* New York: Arno Press.

Wilson, Derek. 1988. *Rothschild: A Story of Wealth and Power.* London: André Deutsch Limited.

Wilson, H., comp. (Printed annually.) *New York City Directory.* New York: John F. Trow. [This title was incorrectly cited in Volumes 1–3 as *Trow's Business Directory of New York City.*]

Wilson, James Grant, ed. 1893. *The Memorial History of the City of New York, from Its First Settlement to the Year 1892.* Vol. 4. New York: New York History Co.

Wilson's Business Directory of New York City. (Printed annually.) New York: The Trow City Directory Co.

Wolfe, Gerard R. 1975. *New York: A Guide to the Metropolis. Walking Tours of Architecture and History.* New York: New York University Press.

Woodbury, David O. 1949. *A Measure for Greatness: A Short Biography of Edward Weston.* New York: McGraw-Hill Book Co., Inc.

Young, James Harvey. 1961. *The Toadstool Millionaires: A Social History of Patent Medicines in America Before Regulation.* Princeton, N.J.: Princeton University Press.

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